American Machinist

Volume 65 New York, July 22, 1926 Number 4

Is England Advancing in Metal Working?

By Colonel F. A. Scott

President, The Warner & Swasey Co.

WITHOUT splitting hairs, it is safe to acknowledge that the machine tool industry originated in England somewhere between the middle of the eighteenth century and the beginning of the nineteenth. It is equally safe to say that Engand and American produced and developed the machine tool industry as we recognize it today. Continuing such a generalization, what are still known as standard machine tools originated for the most part in England, and the development of these tools, and more especially the application of automatic and semi-automatic principles to them, may be credited to the United States. Both nations may make liberal claims for inventive genius in the mechanical field; therefore, an occasional comparison of the two nations and of the respective uses which they have made of their opportunities in metal working may be of advantage to both.

Some of the questions to be answered would be: Has there been equal reason in the two countries for advancement in machine tool buying and use; if so, has the advance been equal?

Is there equal disposition to take advantage of improvement in design and methods of operation?

If inequalities now exist, is time likely to lessen them?

IT HAS been customary for many years to base the prospects of the machine tool industry on the volume of pig iron production. Using for this purpose the figures of the United States and England, and contrasting the period just prior to the war with the year 1925, we find that in 1913 the United States produced 30,653,000 tons of pig iron, and England, 10,260,000 tons. In 1925, the United States produced 36,700,566 tons, and England, 6,200,000 tons. The United States, therefore, shows an increase in pig iron production of approximately 20 per cent, and England shows a reduction during the same period of approximately 40 per cent.

Arguing from these premises, we should find a considerable increase in machine tool demand in the United States during this period, and stagnation in England; but we must remember that, at the best, the calculation of machine tool opportunities by basing them on pig iron production is a crude one. It does not provide at all for one of the largest factors in the market, namely, the replacement of obsolete but still usable machinery by standard equipment capable of a more finished or larger production; or for the introduction of automatic or special machinery designed to meet a particular need.

BASED on pig iron production, it is evident that since the war England has had no reason to increase her machine tool demand. We must, therefore, next answer the question, "Has she shown a disposition to take advantage of improvement in design and methods of operation?" The response to this would be embarrassing were it not possible to base it on expressions of English metal working manufacturers. To answer it only from the American viewpoint would resemble too much an endeavor to exploit our achievements at the expense of a neighbor. The answer given is merely a repetition of comments made by Englishmen with respect to their present status in metal working.

The average British metal working plant has lacked system in scrapping obsolete equipment. In England, in answer to the question, "Why do you do it that way?" the reply very frequently is, "Oh, we have always done it that way." In other words, there seems to be at times a sense of value attaching to a machine or a method just because it is old, and not because it is good in spite of being old. One of the finest things that could happen to English metal working concerns would be for each manager to go through his plant with the eyes of a stranger, and try to see it as he would if he were looking at it for the first time. If that were done, many an ancient machine that still holds a respectable place in the line-up and many a method and operation that were outworn ten years ago, would find their way to the scrap heap.

EVERY metal working country involved in the great war made advances in its methods, and learned something of the problem of quantity production. The lessons of this period have been applied more rapidly and effectively in the United States than in any other country. Without making comparisons between our country and Germany, France, Italy, Russia, etc., but holding entirely to the subject of England and the United States, it may be said that England has been slow to take advantage of the lessons she undoubtedly learned in the metal working during the war. It would be unfair to charge this entirely to reluctance on the part of her manufacturers to change. A part of the delay doubtless is due to an absence of available capital in industry with which to re-equip plants that were

already over-expanded for war purposes. A part of it undoubtedly is due to the attitude of the unions in the engineering trades on the subject of limiting production, which has caused many manufacturers to feel that there was little advantage in securing machinery capable of a larger production, or in attempting to work out more efficient shop plans, when such efforts would be offset to a very large extent by the unwillingness of the men to produce more than a fixed amount.

TWO JOBS that are still ahead of the British manufacturer are indicated by these observations. The first is that he must study production methods and adopt the machine tools necessary for economical mass production in order to bring costs to a basis that will permit competition in world trade, and this must be done by placing machine tool purchasing on an investment basis. The question can no longer be, "Is the tool that is being used a good one?" It must be, "Is the tool that is being used capable of maximum production at minimum cost of production?"

The second job, and one that England must get through with if she is to make real advances as a metal working country, is to convince her working people that the wage earner is not helped by a limit of production; but that, on the other hand, quantity production at good wages is desirable for both the manufacturers and the employee. There are in the United States examples enough of the soundness of this doctrine to convince any reasonable group of British labor men.

Elimination of the limit-of-production rule can never be attained by the unaided effort of capital or of the controlling minds of the metal industry. The soundness and advantage of such an advance must first be appreciated by every one throughout the organization—by union men as well as by non-union men. The co-operation must be general if the full advantage is to be reaped. With such co-operation, it is possible that the metal industries of England may be set well forward, for certainly it cannot be argued that the world at large is over-supplied with the articles of comfort, convenience, safety, and service that originate in, or depend upon, metal working.

IT WOULD be inaccurate to assume that because British manufacturers are conservative and slow to change they are not effective when they undertake a given task. The fact is quite the contrary. The British disposition is to do things well, and they live up very strictly to the standards that they fix. It perhaps is no credit to the United States and to some of our methods of the past, that a part of British scepticism of our manner of doing things rests on their impression that we often produce quantity rather than quality, and that our minds and methods run too much in that direction. The one thing which has served best to educate them out of this false impression is our marvelous automobile production. No mechanic can question either the quality or the quantity of our work in that field.

During the past four years, there has been hanging over England, and discouraging those who might have sought to develop a new industrial program, the threat of a general strike that might ruin all. Fortunately, this threat has now been answered by the British nation. The answer given is one for which the whole world may well render fervent thanks. The general strike showed the world very plainly that the sober, thinking people of England propose to continue to manage their own affairs sanely and conservatively as they have in the past. Such an example of political wisdom and self-control cannot fail to increase the esteem in which England is held. On such stability the security of capital must depend, and we may well look for helpful changes in British industrial conditions as a result of this great obstacle safely surmounted.

The present situation in the machine tool field in England is certainly discouraging because of the existing industrial turmoil. If we assume a settlement of these labor questions, the prospect for increased machine tool sales then becomes good, and it may prove even excellent, although there still exists in England, and there is an effort to stimulate, a sentiment to buy British-made goods. This sentiment is directed more at American-made machine tools than at the German makes, because purchases in Germany redound indirectly to the benefit of the British manufacturer through the operation of the Dawes Plan payments.

SUMMED up, therefore, the situation would seem to be somewhat as follows: The British metal working manufacturer is becoming aware of the weakness of his position, and is being educated to the advantages of improved methods and mass production. America, affording the most successful examples of such practice, will be the field of study, and naturally American methods will be copied, and to some extent American machines will be in demand.

Another factor that will contribute to the re-equipment of British factories is the trend toward higher wages in the engineering trades, and the demand of the laboring people for a higher standard of living. Comparison with American conditions will accentuate this. Consequently, the existing difference in price between British-made machine tools and American-made tools will tend to disappear. American tools, even those of standard makes, are in some cases superior to British tools; and in the semi-automatic and automatic fields the superiority of the American products would probably be conceded. This leads naturally to the conclusion that on design and workmanship, American manufacturers of machine tools appear to have an advantage, but in the matter of price the advantage rests, at the present time, with the English manufacturer.

In the future, the sale of American machine tools in Great Britain will call for a much more intensive cultivation of the field than any that has previously been necessary. Those American manufacturers who really expect to continue a business there may assume that the maintenance of a representative with their British dealer will be an essential. The American machine tool market is the most attractive in the world, and its size makes it entirely possible to produce at reasonable cost certain machine tools of high productive capacity that are also applicable to British requirements. The quantity in which these tools are produced here makes it possible to sell them to British buyers on a basis highly profitable from the standpoint of the user and we may anticipate a good market for them.

American machine tool producers are, therefore, in a position to approach the British trade, and should approach it, in the spirit of helping to solve its problems. We are proving that certain things we are using are of general benefit, and these benefits may well be shared with the English metal working manufacturer to our mutual advantage.

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

THE keenest competition in automobile building in the United States is centering in what is commonly known as the "little six" class, even though the exact term may be difficult to define. Generally speaking a little six may be said to be any car with an engine having six cylinders with bores approximately 3 in. The bores of really little sixes are usually a trifle under 3 in. but since there are a number of cars having engines with cylinders only slightly above 3 in., the methods of manufacture are much alike, particularly in cars below the $1,200 class.

The fact that modern six-cylinder cars can be sold at present prices is a tribute to the designers of the cars, but even more so to the production engineers and to the machine tool builders and tool designers whose work has made possible the amazingly low labor costs that now exist. Still more amazing is the increasingly better quality of workmanship that can now be put into the cars selling at such remarkably low prices. It is not too much to say that both the workmanship and reliability of many of the little sixes now built are far superior to very much higher-priced cars of ten years ago.

As in a number of other cases in years gone by, the lower priced cars have led the way in devising new methods. Most of the methods were doubtless devised primarily to reduce manufacturing costs, but in a number of cases the result has been to secure a product so much more satisfactory as to induce its adoption by builders of the higher-priced cars. The honing of cylinders is one case in point; another is the abandoning of hand-scraped bearings, as a method of securing the best running engine. The merits of "honing" were so thoroughly discussed on pages 51-56, Vol. 64, as to leave little more to be said.

In order to enable the reader to study the methods used by different builders of automobiles, certain units will be selected and the various production methods outlined and illustrated. As the cylinder block is perhaps the main unit in the engine, it will be considered first. All operations will not be shown; only those that show different methods and tooling in the various shops. An outline of the sequence of operations will be given, as the operations vary for several reasons, being affected by the shop layout, the quantity produced and the ideas of the superintendent.

Cylinder Blocks for the Oakland "Six"

THE cylinder blocks for the Oakland engine differ from many others in being cast separately from the crankcase. This design makes the parts considerably lighter than when they are cast together, and facilitates handling between operations, as well as in clamping in the machines. The cylinder block is shown in Fig. 1, clamped on the rotating drum of a Newton milling machine, which surfaces both top and bottom of the block. The clamping is very simple. Stellite cutters are used for roughing, and high-speed steel cutters are used for finishing.

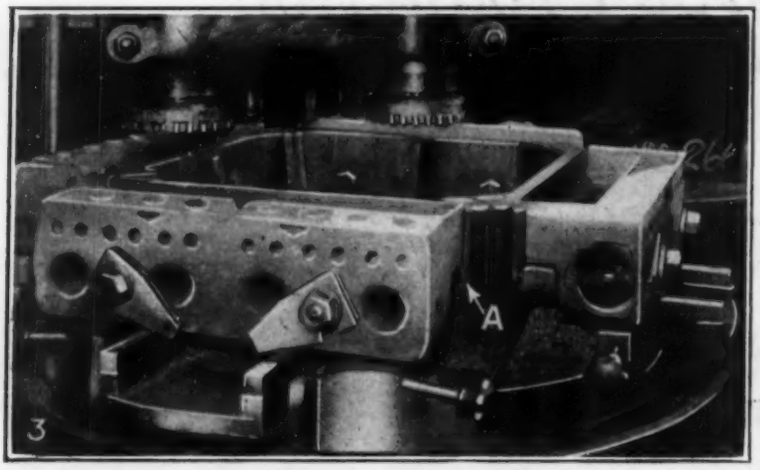
The bolt holes are drilled in the bottom flange in the rotary fixture in Fig. 2. There are 12 holes, in pairs between cylinders and at each end. The fixture is double, with a quick clamping device, and has substantial pillars to locate both it and the work, with relation to the drilling head and bushing plate. The end holes are hand reamed for locating points in the operations that follow, after which the manifold side of the block is milled on a horizontal, Newton rotary machine as in Fig. 3. The blocks are located on dowels in the end holes, as at *A*, and are held by the two bolts and the slotted washers shown. Two cutters are at work milling two separate blocks.

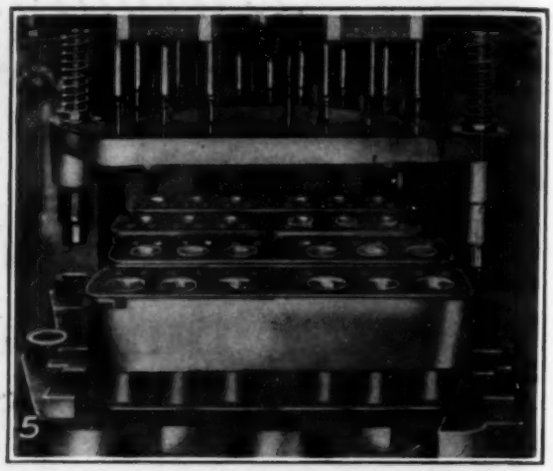
A battery of Foote-Burt machines, Fig. 4, rough and finish bore the cylinders. In this view, the conveyor line and the convenient grouping of the machines can be seen, as well as the method of mounting the electric motors and the inclosed drive. The cylinders are also reamed in this group of machines. The top and bottom faces are then finished by grinding on a Blanchard machine, as in Fig. 6. The operation is rapid and leaves a good surface for the joints on both ends of the cylinders.

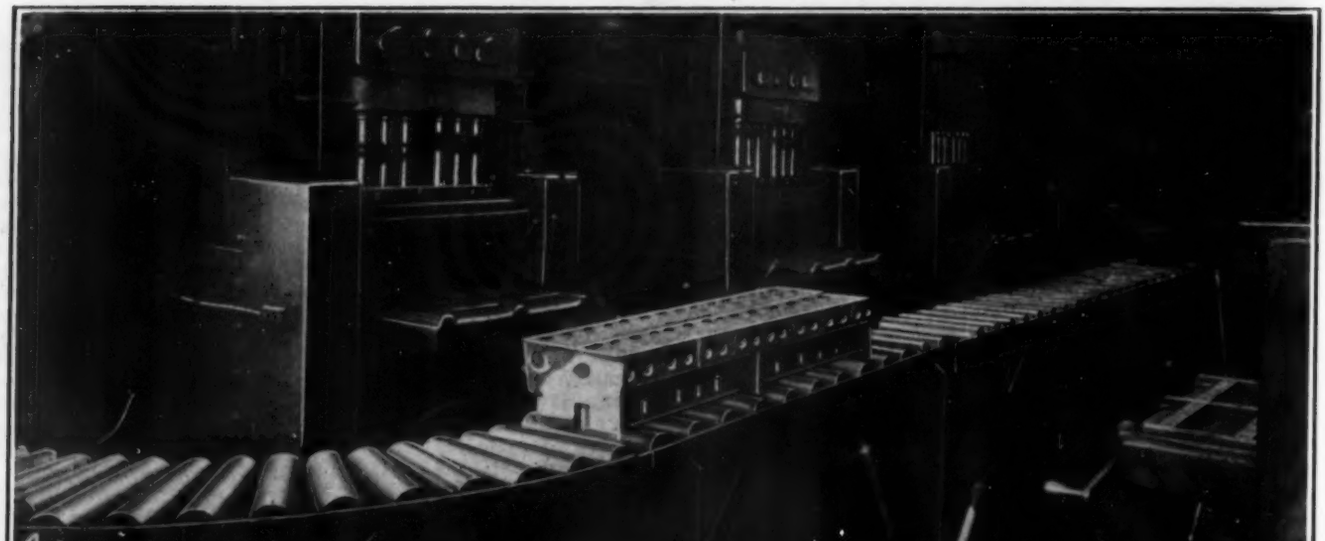
The end stops and the side plugs hold the blocks against the thrust of the grinding wheel, while the magnetic chuck holds them squarely on the table. The holes in the upper ends of the cylinder blocks are drilled in pairs in the fixture in Fig. 5. The rotary table holds four blocks, the drill head being laid out double. The bushing plate is guided by the heavy pillars shown.

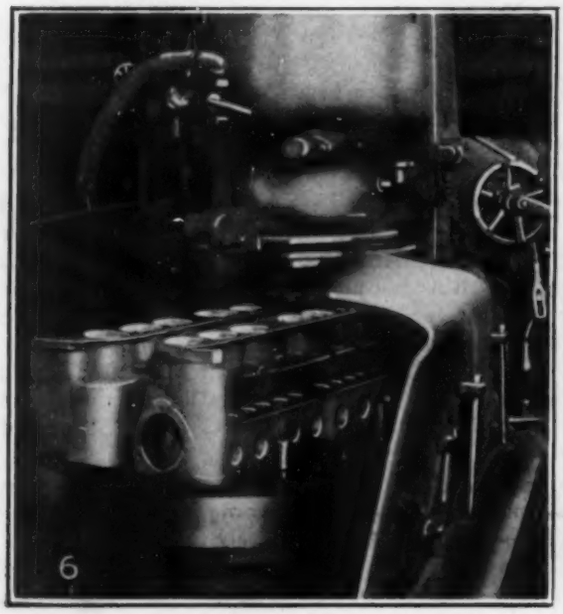
The first article. The second will appear in an early issue.

Automotive Production









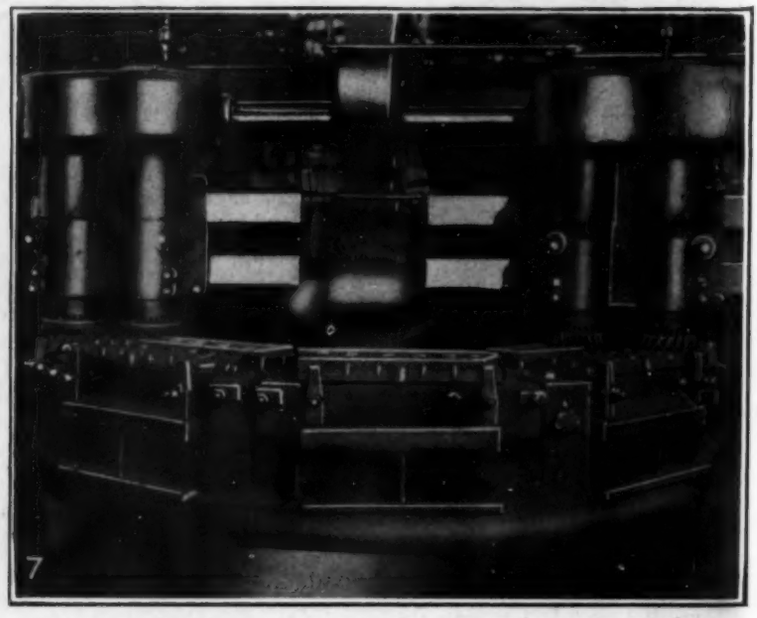
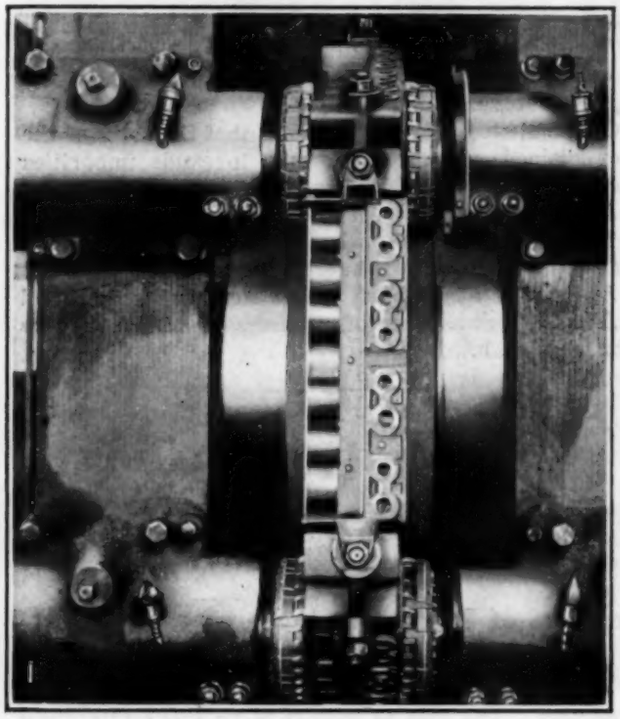


Fig. 3—Milling four manifolds. Fig. 4—Battery of cylinder boring machines. Fig. 5—Fixture for drilling two blocks at once. Fig. 6—Finishing ends on grinding machines. Fig. 7—Milling the cylinder heads

Automotive Production



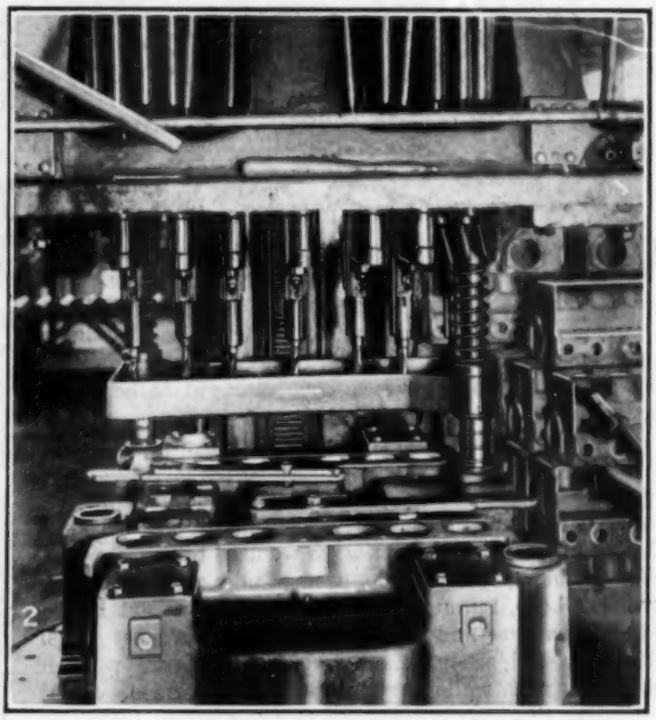


Fig. 1—Surfacing both ends on rotary miller. Fig. 2—Drilling bottom flange

The blocks are located from the bores. The cylinders are finished by honing in a machine that makes about 52 strokes per min., being rotated at a somewhat higher speed.

Rotary milling machines of the Newton type are also used for surfacing the cylinder heads as in Fig. 7. Four cutter heads are used, one pair roughing and the other pair taking the finishing cut. The cylinder heads are arranged in pairs, the inner heads having the joint faces up, while the bolt bosses and the pads for the water outlets are being milled in the heads in the outer row. A study of the fixture will show the method of clamping the heads.

In the method of drilling the heads, Fig. 8, two heads are drilled at once. The bushing plate carries 54 drill bushings, and is guided by the large pillars. The indexing of the table brings another pair of heads under the drills.

Fig. 8—Drilling two heads at once

One of the interesting features brought out in this article is the tendency to adopt methods that include the use of continuous operation machines. And where this is not considered feasible as yet, the continuous idea is carried out as far as possible, in the design of the fixtures used. Three of the illustrations show continuous milling, as in Figs. 1, 3 and 7. In all of these the work is put in place and removed while the machine is in operation. In two of the machines both roughing and finishing cutters are provided so that the work need be handled but once. In the other operation, Fig. 3, one cut is all that is required.

The use of rotary fixtures is shown in Figs. 2, 4 and 8. And while the operation is not continuous, the only idle time is that due to the indexing the fixture to its new position. In all these fixtures the finished work is removed and the new piece clamped in place while the other piece is being machined.

Although not brought out specifically in this article, there is an increasing use of the grinding machine, mostly for finishing operations, but also for some others that do not strictly come under this heading. One feature is the use of more than wheel in some jobs.

There is also a growing use of conveyors, even though the automobile plants have always utilized them extensively. Conveyors not only make it easier to handle work but there is less delay as parts are kept moving. Then, too, conveyors have a direct bearing on the amount of material in process. They also allow production to be varied from maximum to minimum, or held at any intermediate point.

Automotive Production

Seen and Heard

Iron for machine ways—and how to season it

BY JOHN R. GODFREY

WHENEVER any mechanic gets the research bug, the first thing he tackles is cutting tools. He seems to want to prove that Fred Taylor was right—or wrong. At any rate that is the first idea that bobs up in most cases. Perhaps it's because there are still a few heretics who believe that metal ought to be "cut" instead of "torn" off of the casting or forging.

One of my good friends, who is both a mechanic and a thinker, wants the research bugs to lay off of cutting tools for a while and do a little researching on iron castings. He wants to know whether or not there is anything in "aging" or seasoning as we used to think. Some lathe builders, for example, used to take a roughing cut over the beds, top and bottom, and put them out in the yard to season—and incidentally, to rust in most cases. Others would season them by using a large wooden battering ram, walloping the castings at various points to induce the internal stresses to come out of hiding.

Automobile motor builders used to do the same with cylinders, while some annealed them after the rough boring. Now instead of annealing or seasoning for weeks, many cylinder castings hardly get cold between the foundry and the finished car. And in spite of this, we are getting better cars than ever before. The one great difference between the lathe bed and the motor, however, is that the motor is hot when at work and the lathe bed is cold.

Then, too, there is the question of what kind of iron to use in the bed. Some contend that a fairly soft, open grain iron wears better than either semi-steel or chilled iron—and furthermore, that it does not scratch so easily in use. And they show you planer beds of soft iron that have run for years without scratching and beds or other surfaces of either chilled iron or semi-steel that show scratches after a few hours.

Semi-steel, however, consisting of about 20 per cent steel scrap, seems to be very popular, although the chilled way still has its advocates. But it must be remembered that the depth of an efficient chill is limited, and that if a very heavy cut is required to clean up the casting, most of the chill will disappear with the chips that are removed.

Here is a subject for a little research that can be done at comparatively small expense. By making sections of different material and subjecting them to the same sliding action as in a planer, it should be easy to determine which metal gives the best results. This method is somewhat similar to the way the civil engineer tests road-building material. He divides a road up into sections and uses the different material in the various sections. Since each section gets the same wear he can tell which material is best suited to that particular kind of traffic.

In a somewhat similar way, lathe or planer beds, or pieces resembling them, could be cast and seasoned by different methods. The difference in distortion could be easily noted as well as the effect, if any, on the wearing or scratching qualities.

One semi-steel advocate contends that the pores of the open-grained, soft iron, continue to exude impurities such as minute particles of sand that act as an abrasive and cut out the ways. All of which is directly contrary to ideas that the open-grain iron is less apt to scratch than either the chilled iron or the semi-steel.

At ay rate it isn't hard to find out who is right, and builders as well as users of machines would like to know which is which.

Abstracts

from other publications

Features of Worm Gearing

The recent development of the motorcoach has brought out many salient features that the worm-gear possesses. The first is that it is an inherently silent form of final-drive. The second is that it retains its silence throughout its life. Records of mileages with one set of gearing of 500,000 miles are common.

The third advantage that the high speeds and heavy loads of the motorcoach brought out was that the worm gear is able to resist shock loads without damage. The resultant forces reacting on the bearings of a worm-gear set are such that no displacement tending to throw the tooth surfaces out of contact or out of mesh occurs. In other words, the loads on the bearings supporting the wormwheel are in the same direction, while, in a bevel gear, the loads on the bearing supporting the ring gear are reversed on one side as compared with the other.

The fourth advantage is brought out in the manufacture of worm gearing. By its very nature, the worm-tooth contours may be ground; that is, the tooth surfaces can be generated with a grinding-wheel after all such operations as heat-treating, carburizing, and the like, have been performed. L. K. Buckendale in *The Journal of the Society of Automotive Engineers*, July, 1926, p. 652.

Magnetic Control of Planetary Gears

M. Cotal has devised a planetary transmission gear that is attracting the attention of French automobile builders. All spur gears are used and the usual brake bands are replaced by magnetic clutches controlled from the steering post. Numbered contacts energize the corresponding clutches and secure the desired speed ratio between engine and rear axle. It is made with three or four speeds and is said to be quiet in operation. Should the electric current fail there is provision for emergency operation by mechanical means. The current consumption is from 8 to 25 watts—*Automotive Industries*, June 17, p. 1045.

Production of Integral-Key Plungers

By A. M. Lindsley

Plungers with assembled key not rigid—Integral-key type ideal but difficult to manufacture — Solving the problem — Layout of operations and tools

EARLIER types of plungers used on paper box wrapping machines were made with the key assembled to the wall of the plunger. Since the wall is less than $\frac{1}{8}$ in. in thickness on the piece, and since size, concentricity, and straightness are held within narrow limits, a fragile construction resulted. This construction has been responsible at times for serious trouble in the operation of the wrapping machine. The integral-key plunger illustrated in Fig. 1 was developed by the Stokes and Smith Co., Philadelphia, and eliminates almost entirely the possibility of trouble with this part. The solid plunger, while at first appearing more complicated to manufacture than the old type, has been produced at a lower cost than the former built-up plunger.

The integral-key plungers are machined from $1\frac{11}{16}$ in. diam. bars of tobin bronze, in a series of operations, the sequence of which is shown in the accompanying table. The rough and finish milling is accomplished on a horizontal milling machine, the deep hole is machined accurately on a hollow hexagon turret lathe, and after several minor operations, the outside diameter and key are finished to size in two passes on a broaching machine.

The preliminary, or rough milling, set-up is pictured in Figs. 2 and 3, while a cross-section through the fixture is shown in Fig. 4. The first operation, after the cutters have been set to sample pieces, is to mill the key from solid stock on one piece at *A*. When this has been done, piece *A* is transferred to *B*, where the key is located in the keyway of the fixture, and a fresh piece is inserted at *A*. Thereafter two pieces are operated on, and a finished piece is produced at each pass of the table.

The fixtures consist of two long V-blocks fastened to the table, with end blocks to take the thrust of the cut,

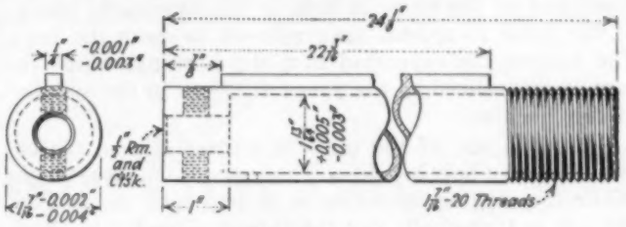
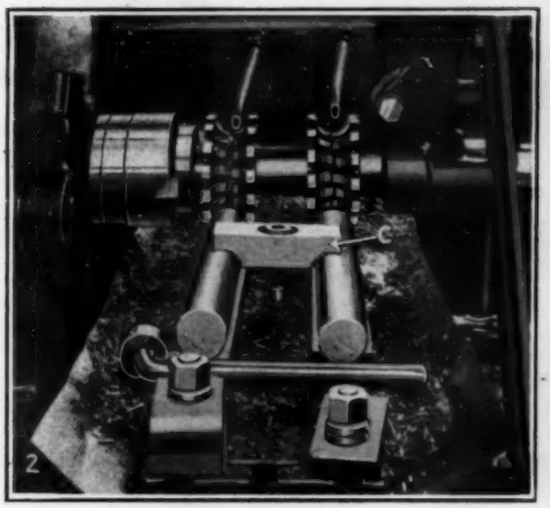


Fig. 1—Integral-key plunger

and two clamps *C*, Fig. 2, one of which is placed near the end of the cut, while the second is placed about 8 in. from the start. After the cut has progressed several inches, this second clamp is removed and replaced behind the cutters.

Due to the fact that the cutters work on practically the entire exposed surface of the piece, and also to the tendency of the cutters to pick up the pieces when the direction of feed is against the cut, the operation is reversed, and the table is fed in the same direction that the cutters are rotating. Under these conditions the cutters assist in holding down the work on the V-fixtures, chatter is eliminated, necessity of clamping



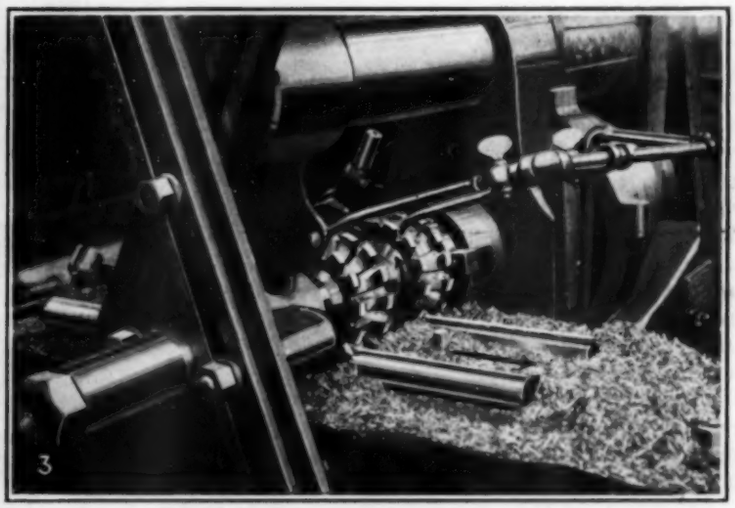


Fig. 2—Clamping the work. Fig. 3—Rough milling operation

close to the cut is obviated, and the operation when once started, progresses without interruption to the end.

The cutters *D* and *E*, Fig. 4, are so form-relieved that the proper radius is milled when the teeth are ground with a rake angle of 10 deg. The relief is universal, and the cutters are made in interlocking halves, with spacing shims between. When the cutters are sharpened, it is only necessary to bring the halves a trifle closer together by reducing the shimming, to preserve the correct width of key and size of radius. This feature also makes it possible to rough and finish mill with the same set of cutters, by removing the proper amount of shimming between the roughing and finishing operations. The shape produced by the roughing cut is, of course, not exactly correct, but this fact is of no importance since the error lies well within the finishing allowance of $\frac{1}{32}$ in. on the diameter of the work. The proportion of stock removed by each cutter is shown at *H*, Fig. 4, The time for the rough milling cycle is approximately nineteen minutes.

Following the rough milling, the plungers are sent to the turret lathe for finishing the deep hole. The front end of the piece is held in the automatic chuck of the lathe in special jaws relieved to clear the key. The rear end is supported in a slip bushing, which in turn is centralized by the support rollers in the spindle of the machine.

After the end of the piece is spotted with a center drill, the deep hole is drilled with a special oil-feed drill. While the drilling operation is in progress, the end of the key is turned off, and the thread diameter is sized accurately by a tool in the square toolpost. Following the drilling and turning, the hole is finish-reamed to size by a spiral, oil-feed reamer. The reamer is provided with end-cutting teeth for squaring the bottom of the hole. Lubricant is supplied to the drill and reamer through a system of piping and flexible joints. The next operation, chasing the thread, is illustrated in Fig. 9, after which the end is faced and the hole is chamfered for centering in the finish-milling fixture.

The plunger at this stage of manufacture has been reduced from 16.5 lb. in the original bar, to a 4-lb. semi-finished part. This reduction in weight is accompanied by a considerable amount of distortion, and a straightening operation is necessary before further machining can proceed. The straightening operation is accomplished in the engine lathe, and is followed by the operations of facing, drilling the $\frac{11}{32}$-in. hole, and centering the rear end. The bore of the plunger is now straight and true, and the piece next progresses to the finish-milling operation, where the outside is finished in concentricity with the bore.

The plungers are finish milled in a duplex fixture, in a manner somewhat similar to the method employed in rough milling. The piece is held on cone centers, which fit into the female centers turned in the piece during the turret and engine lathe settings, and centralize the piece with the bore. The plunger is further supported by adjustable V-blocks. The semi-finished piece, after being milled on one side, is transferred to the other block, and a finished piece is produced at each pass of the table. A cutting speed of 122 ft. per min., and a relatively light feed, 0.20 in. per rev., are used to prevent deflection of the pieces. A stock allowance of 0.004 in. is left on the diameter of the plunger for broaching.

After milling the outside, a short section of key is milled from the rear end, the drilling and tapping of the transverse hole is accomplished, and the $\frac{1}{2}$-in. hole is bored and recentered in the engine lathe. At this stage the pieces are again straightened, and then go to the final machining operation, that of broaching the outside diameter.

The plungers are finished accurately to size in two passes through roughing and finishing plates on a

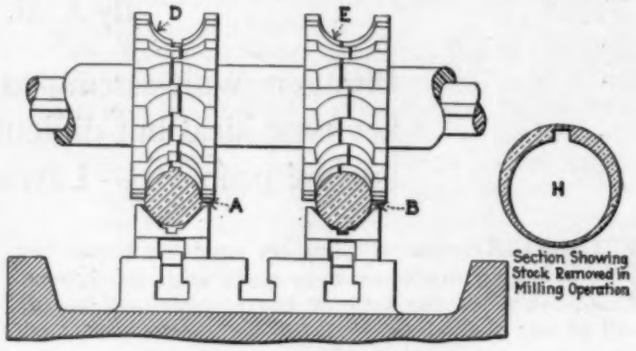


Fig. 4—Rough milling from the bar

Lapointe broaching machine. The roughing plate removes all excess stock, eliminates tool marks, and takes practically all the wear of the broaching operation. The finishing plate removes only about 0.001 in., and as the wear is extremely minute, the passes per grind will be correspondingly great. This is essential, since the construction of the broach prohibits repeated regrinding. The broach is sharpened by grinding the face, and as the hole has a clearance, a small amount of regrinding would destroy the accuracy.

A quick acting clamp facilitates setting the piece for the cut. This clamp *A*, Fig. 5, consists of a fixed lower jaw, and an upper movable jaw, which is actuated by the cam face on the lower end of the clamping lever. The clamping faces of the jaws are threaded to match the thread on the plunger. The threaded end of the piece is passed through the profile in the broach plate, and the thread is engaged in the thread of the jaws.

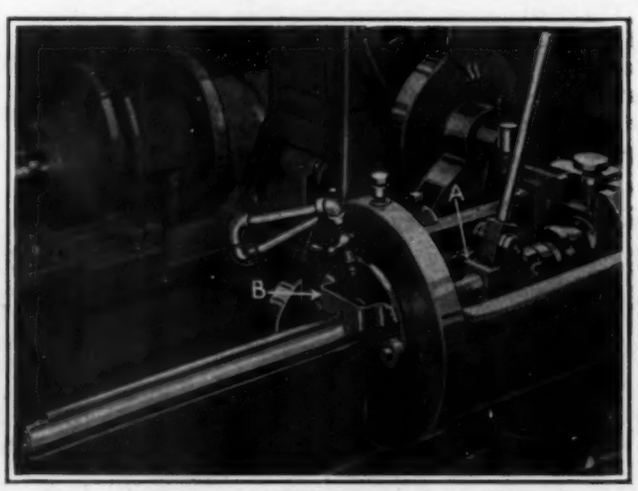
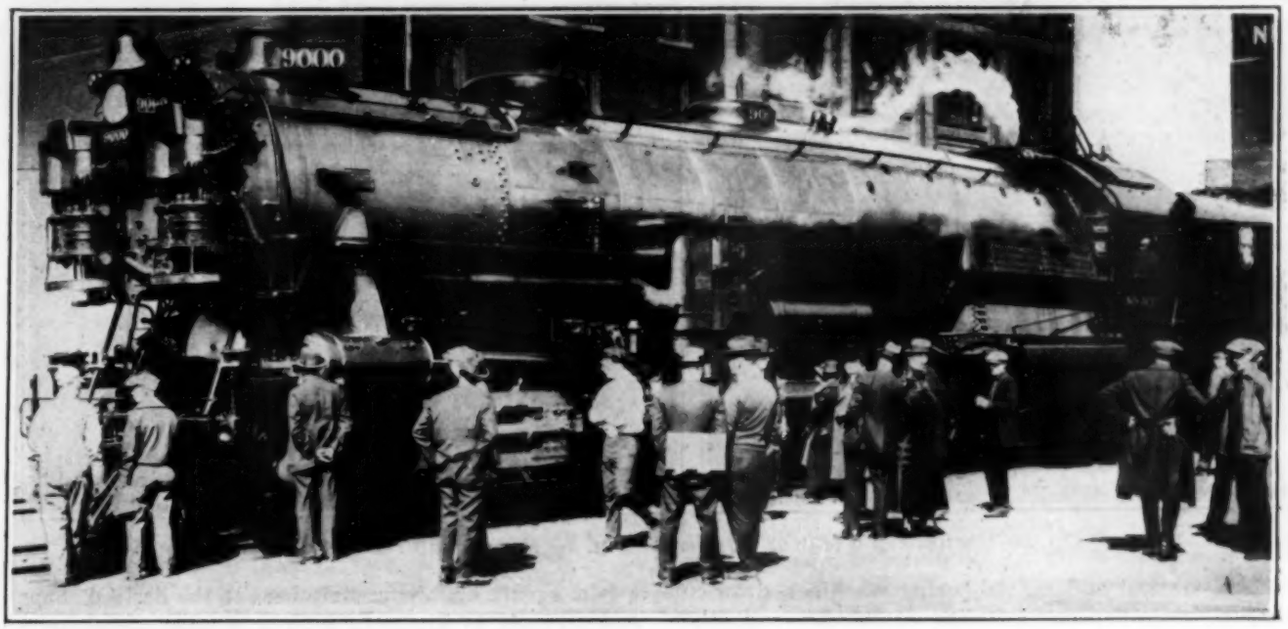


Fig. 5—Broaching the outside

A guide bracket, *B*, on the broach plate locates and aligns the key on the plunger. During the cutting action, a stream of heavy-base cutting oil lubricates the cut and improves the finish.

The final operation of removing the burrs, cleaning and gaging, completes the manufacturing sequence, and the plungers are finally inspected and passed to the storeroom.



Machining Methods That Cut Locomotive-Repair Costs

By Frank W. Curtis
Western Editor, *American Machinist*

ONE of the outstanding problems in any shop is the routing of work to machines that offer economical handling, satisfactory production and uniform accuracy. It is not possible always to handle work in the most efficient manner, due to the prevailing equipment but, in such cases, the aim should be to reach the nearest approach to the better method. If new equipment could be obtained whenever desired, manufacturing problems would be simplified to such an extent that a great many of the ingenious operations now in use would not be seen. However, a strong effort should be made to keep the machine equipment modern and up-to-date in order to avoid serious losses in production and through inferior work.

Working in this direction, the Union Pacific R.R. shops at Omaha, Neb., are able to handle locomotive repairs efficiently. To meet increases in repair work, the back shop has been enlarged on three occasions, the first when an 88-ft. connection between it and the boiler shop was made, the second being a new 200-ft. addition, and the third a further addition of 400 ft. At present the back shop is 1,088 ft. in length and is well equipped with a variety of modern machine tools. When a machine becomes obsolete, an effort is made to replace it. The equipment includes such machines as frame slotters, boring mills, slab

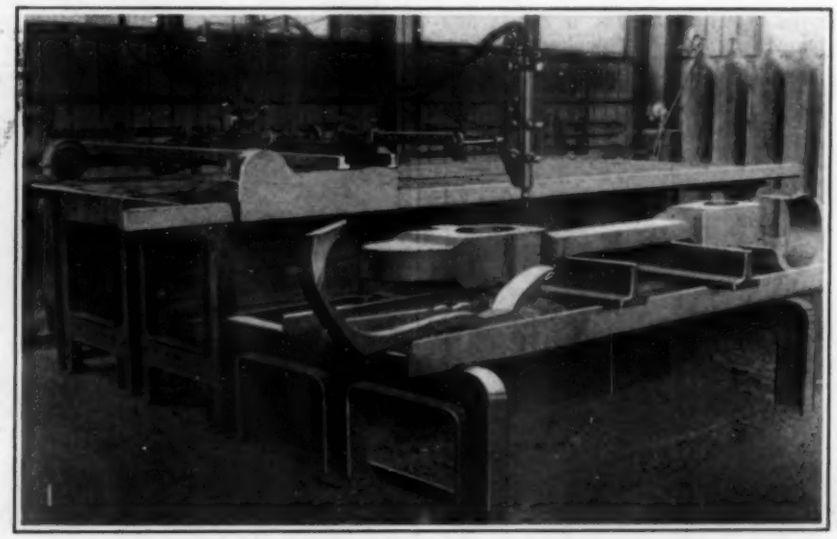


Fig. 1—Cutting out an intermediate rod in a shape-cutting machine

The first article. The second will appear in an early issue.

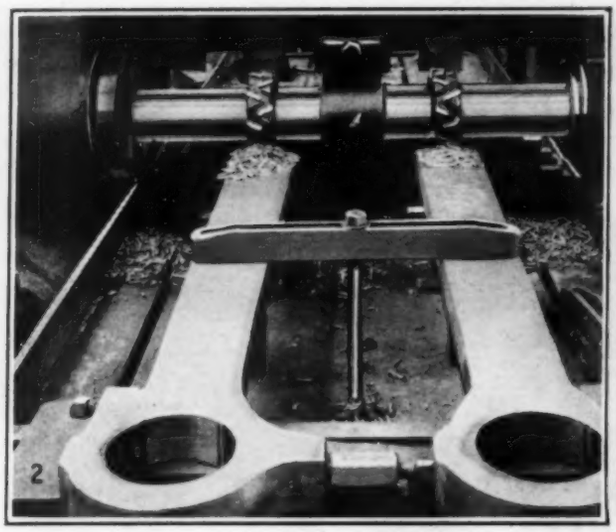


Fig. 2—Channeling a pair of side rods.

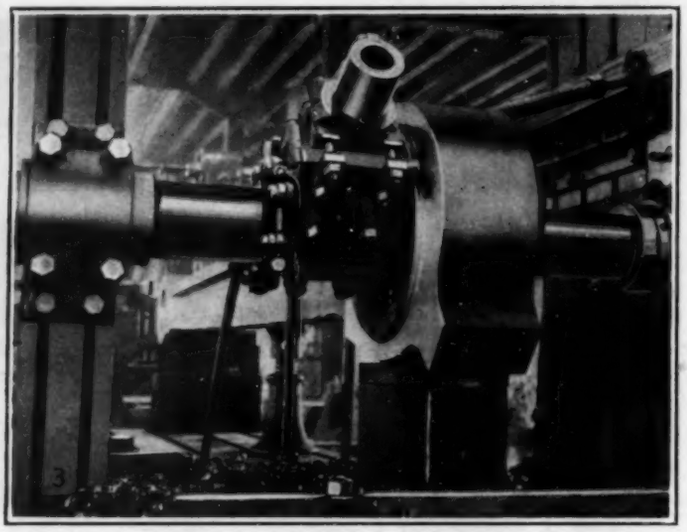


Fig. 3—Facing hub end of main rod

millers, vertical millers, rod-boring machines, draw-cut shapers, miscellaneous grinding equipment, and other railroad-shop tools. Individual motor drives are applied to all machine tools, this feature adding materially to the appearance of the shop as well as affecting the power cost.

The headpiece illustrates the latest addition to the motive power of this road. The locomotive, constructed with three cylinders, is used to haul mile-long trains of perishable foods over the continental divide at 50 m.p.h., whereas the present mountain freights only make 20 m.p.h. It measures 102 ft. in length, 16 ft. in height, 11 ft. in width, and weighs 782,000 pounds.

One of the most recent additions to the shop equipment is the Oxweld shape-cutting machine shown in Fig. 1. Small rods, equalizers, knuckle-pin nuts, frame pedestals, motion parts and many similar units are shaped in the machine. Some of the parts are made from flat steel while others require forging to bring them to a proper thickness. The machine, semi-automatic in operation, has a carriage that runs longitudinally on four rollers over the table. Mounted on the carriage is a tracing unit that likewise travels on four rollers but at a right angle to the carriage movement. The pattern of the work to be cut is made of a ⅜-in. square aluminum strip bent to the desired shape and fastened by rivets to a piece of sheet-metal backing. It is clamped to the table, after which a hardened, tapered, gear-like follower, driven by a small motor, is brought in contact with the upper edges of the aluminum strip. The follower has a tendency to embed itself in the strip, making teeth somewhat similar to those of a rack, so that after the strip has been used once it offers a positive feeding action.

Extending beyond the tracing unit is mounted the cutting torch. It can be moved in or out to suit the position of the work in relation to the pattern. The work is placed on supports that rest on stands located in the front of the machine. A forged intermediate rod is shown in the cutting position, and at the ends may be seen the scrap pieces cut from it. Both holes of the rod also are cut in the machine. The rod, 6 in. in thickness at the ends, is cut at a speed of 6 in. per minute. Once the tracer is positioned, the cut is automatic with the exception of the holes.

Before finished work is taken to the shop for machining, it is annealed in a furnace located in an adjoining room. The cutting machine and furnace are housed in a small building of special construction adjacent to the back shop. The use of the machine has necessitated the rerouting of several parts, eliminating machin-

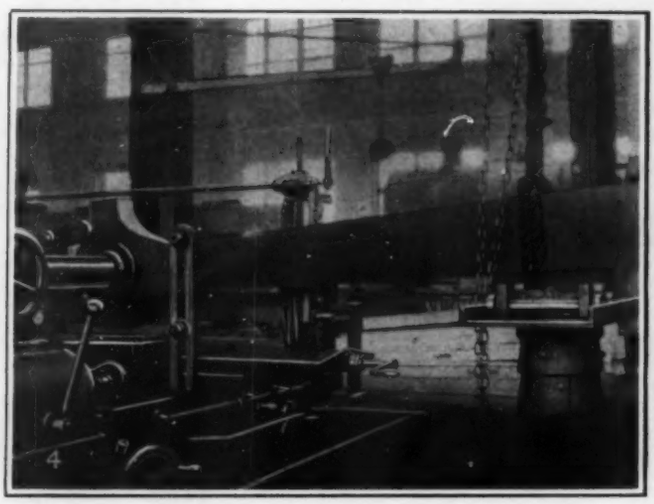


Fig. 4—Internal grinder used on rod work.

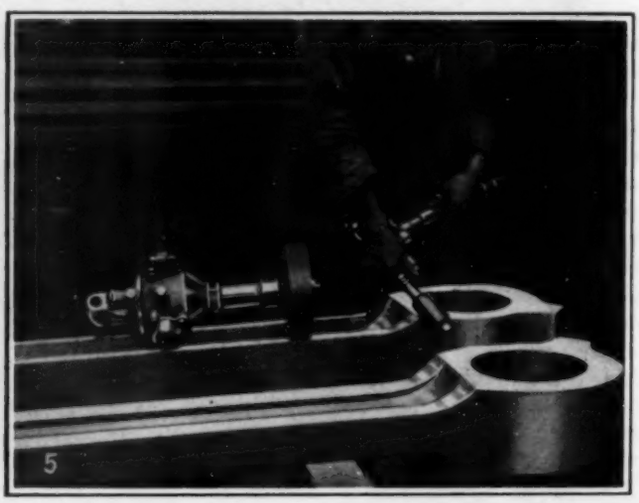
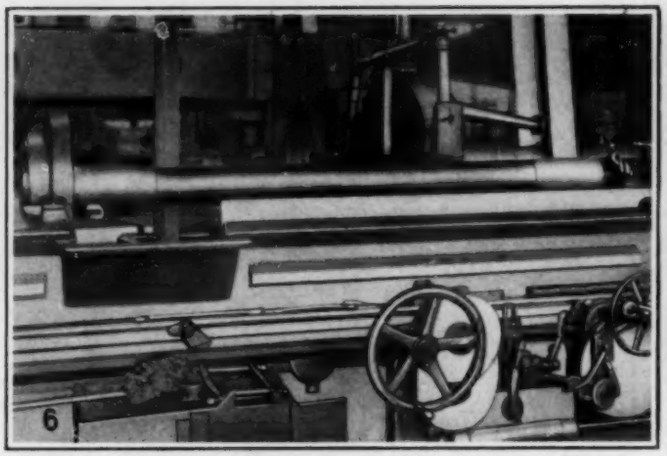


Fig. 5—Breaking the sharp corners of rods



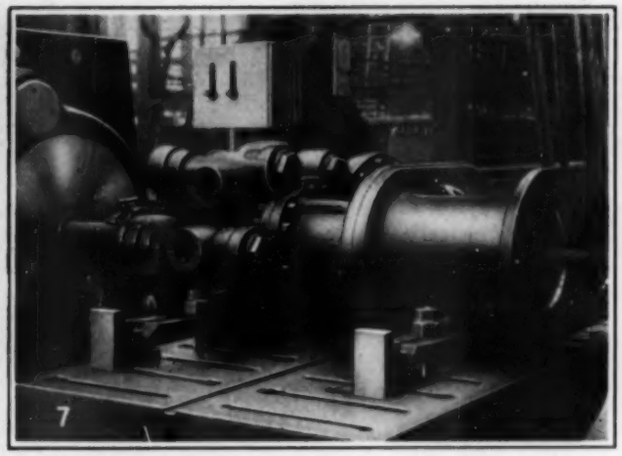


Fig. 6—Grinding a piston rod. Fig. 7—Air pump cylinders being rebored

ing operations and, in some cases, has relieved the congestion of work at certain machines.

Connecting rods are machined in lots of six or more and are carried through their routed operations in such quantities to eliminate unnecessary set-up time. In Fig. 2 is shown a Newton milling machine that is used for slabbing, edging and channeling. Two side rods are shown positioned for channeling. The rods rest on parallels and are clamped at the ends by cam-acting hold downs having serrated contacting surfaces. Two U-clamps are used to hold the work in the center. Only one is shown, since they are removed as they approach the cutters and are reset at the rear when the work has proceeded sufficiently. Adjustable jacks are used under the clamps to keep the rods from springing. Two 10x3½-in. inserted-blade cutters, operated at 12 r.p.m. and 3-in. feed per min., are used.

Hubs of rods are faced on the large ends in the Morton machine as shown in Fig. 3. The rod is located by both ends on blocks, while in the center section a jack is used to add additional support. The clamps are steel straps held in place by 1-in. bolts. The machine is used also for planing cylinders, boring valve chambers, milling cylinder-valve ports and seats, and miscellaneous slab-milling operations.

Connecting-rod holes are ground in a D.G. Micro grinder, as illustrated in Fig. 4, where a rod is shown mounted on an angle plate preparatory to grinding the large hole to 11 in. in diameter. The work is clamped by its finished face against two vertical parallel bars located on the face of the fixture, so that ample clearance for the grinding wheel is obtained. A vertical adjustment of 2 in. is provided, while cross adjustment can be made with the machine table. These adjustments enable the hole in the rod to be brought central with the circular path of the abrasive wheel. To avoid an excessive overhang and to reduce vibration, the outer end of the rod is supported on the roller stand shown to the right. The stand is located at the balancing point of the rod to relieve the machine of undue strains. In the illustration, part of the projecting rod is being lowered onto the roller carriage.

All connecting rods, piston rods, crankpins and axles are made of carbon-vanadium steel. They are polished after being machined as a precaution against cracks that may be caused by tool marks or deep scratches left on the outer surface. Shoulders and sharp corners likewise are avoided as far as possible. In Fig. 5 an operator is shown breaking the corners of a main rod with a hardened steel burr, 2 in. in diameter and 3½ in. long, driven by an air motor. To the left is seen a polishing wheel and an air motor used for buffing other surfaces of the work. The material takes a high polish similar in appearance to nickel-plated work.

The grinding of piston rods is shown in Fig. 6. The 4½-in. rod, mounted in a Norton cylindrical grinder, is ground by a 20x4-in. abrasive wheel. The corners of the wheel face are dressed to a radius to provide a fillet in the shoulder of the work. Axles and pins also are handled in the machine.

Air pumps are rebored in the Niles-Bement-Pond horizontal boring machine illustrated in Fig. 7. The cylinders are not removed from the center casting as is frequently required. The work shown in place is a 5-in. pump in which all of the four cylinders are being bored. A roughing cut, removing approximately $\frac{1}{8}$ in. of metal from the bore, is made, after which a finishing cut is taken. An average of 5 hr., floor to floor, is required for completing the operation. An overhead crane is used for loading the work.

A Foreman's View of Salary

BY JOSEPH P. LEECH

I have read many articles in the *American Machinist* recently concerning foremen, and have wondered if these advocates of high-class men have taken into consideration the amount of salary paid to first-class foremen. The foreman's rate of pay is often so close to what the men under him are receiving that he cannot hold himself apart; he has to live in the same neighborhood, trade at the same store, and do exactly as the men under him. This being the case it is impossible to maintain proper discipline, because the foreman must have friends, and he must live within his means, and therefore he is compelled to associate freely with the men. I do not mean to infer that the men are not worth associating with, but a foreman must treat all of his men alike, and he cannot do it if he has close friends.

In my opinion manufacturers must place their foremen's salaries at a higher level if they expect to get maximum results, and if this is done it will not be necessary for the management to worry about production. I have known cases where good, competent men have refused offers of foremanship because the pay did not compare with the added responsibility.

Book Reviews

Automotive Giants of America. By B. C. Forbes and O. D. Foster. A collection of 20 interview articles that appeared in *Forbes Magazine*. Two hundred and ninety-five pages, 5x7¼ inches. Illustrated by halftones of the men interviewed. Published by B. C. Forbes Publishing Co., 120 Fifth Ave., New York. Price $2.

The interview articles collected in this volume are of the type intended to glorify the American business man. They show in an interesting way the early struggles of twenty of the leading lights of the automobile industry. From the viewpoint of an engineer it is encouraging to note that the great majority of the men chosen have made their way up through the production side of the business. There is a certain amount of inspiration in most of the stories but some of them are not enlivened by the financial statistics that are dragged in. The book is better taken in small bites unless one is addicted to hero-worship.

The men honored by inclusion among the favored twenty are Harry H. Bassett, Roy D. Chapin, Walter P. Chrysler, William C. Durant, Albert R. Erskine, Harvey S. Firestone, Henry Ford, Charles D. Hastings, Frederick J. Haynes, John Hertz, Edward S. Jordan, Charles F. Kettering, Alvan Macauley, Charles S. Mott, Charles W. Nash, R. E. Olds, Alfred P. Sloan, Jr., H. H. Timken, Walter C. White, John N. Willys.

The Metallography and Heat Treatment of Iron and Steel. By Albert Sauveur, Sc.D., Gordon McKay Professor of Metallurgy and Metallography in Harvard University. Third Edition (Eleventh thousand). Five hundred thirty-five pages, 7x10½ in., cloth boards, four hundred sixty-nine illustrations and diagrams. Indexed. Published by The University Press, Cambridge, Mass. Price $8. (Foreign 34s.) net postpaid.

In this revised edition the author has incorporated the advance recorded in the metallography of iron and steel during the past decade, as the second edition was published in 1912. One of the most valuable additions to this work is a number of high-power photomicrographs by F. F. Lucas with magnifications ranging up to 3,500 diameters that throw considerable light on the structure of metals. The book is written primarily for those who seek fundamental information on the science of metallography, but the language used is such that the book can be read by those lacking specialized knowledge of the subject. It is exceedingly understandable for so complex a subject, due perhaps also to the logical manner in which each fact or theory is presented. The author does not give undue prominence to his own views but on the contrary gives a great deal of space to the opinions of other authoritative investigators. On the other hand lengthy descriptions of controversial matters or speculative theories are avoided.

The first six chapters are devoted to a general discussion of metals, steel and wrought iron, and the effect of impurities. Several chapters discuss the thermal critical points of iron and steel—their occurrence, their causes, and their effects. Chapters on heat-treatment include annealing and normalizing, hardening, tempering, cementation and case hardening, and miscellaneous treatments. The more important alloy steels are studied, then cast iron together with its impurities, and malleable iron. A discussion of the equilibrium diagram and the phase rule is left to the last two chapters.

The appendix comprises over eighty pages. Laboratory manipulations and the optics of metallography are first considered, then the tentative recommended practice for thermal analysis of steel is given. The last includes the procedure for the preparation of the specimens, the method of testing, and instructions on photomicrography. A description of the methods of F. F. Lucas in preparing specimens is also given.

Management Through Accounts. By James H. Bliss, President of the Illinois Manufacturers' Cost Association, a certified public accountant, and Assistant Professor of Accounting in Northwestern University. Eight hundred fifty-one pages, 6x8½ in. Cloth boards. Cross-indexed. Ninety-five figures. Published by the Ronald Press Co., New York. Price $6.

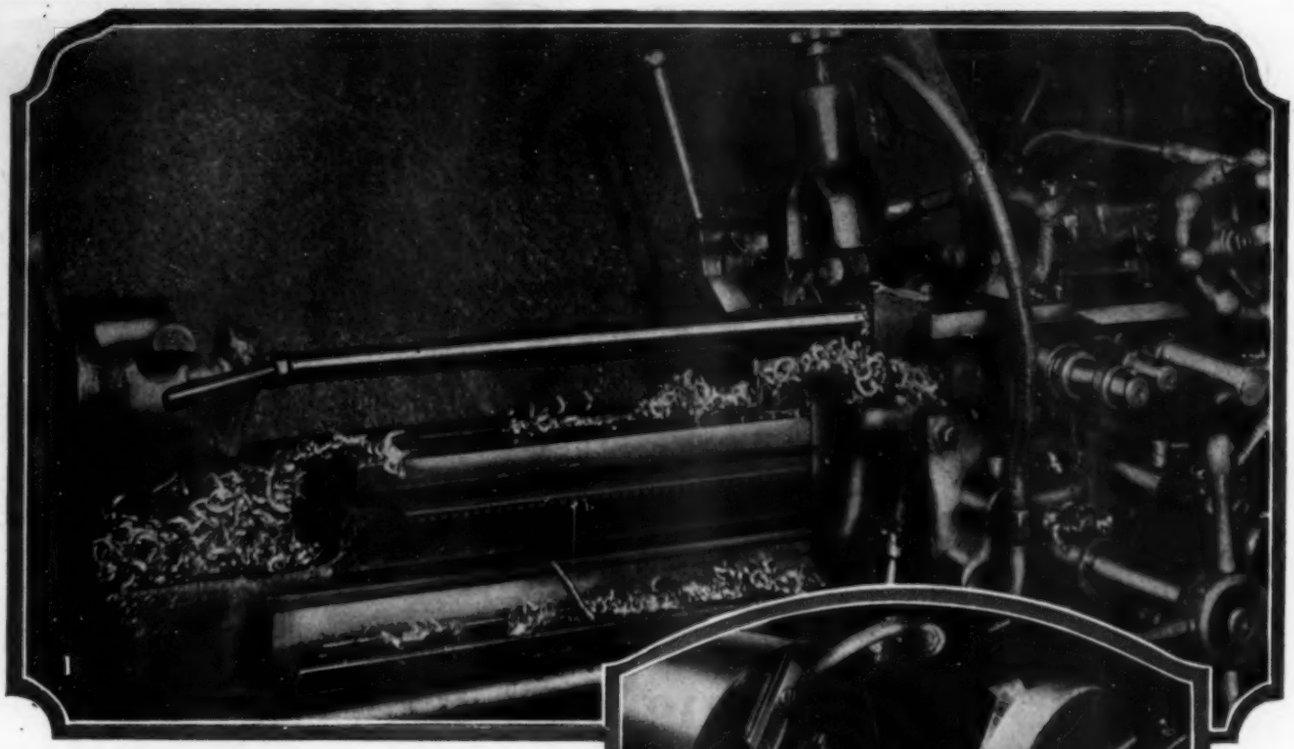
Accounting in a manufacturing business is too often considered by the management as an unproductive burden, but the author of this book sets out to show that the industrial accountant can do much to point the way to profitable business. He maintains that the accountant should take the initiative by producing and interpreting to the executives the reports and statistics that are essential in order to show the true trend of the business. The author further states that the published reports of representative corporations indicate wide divergence of methods, and often poor analysis, so that proper insight into a business is difficult.

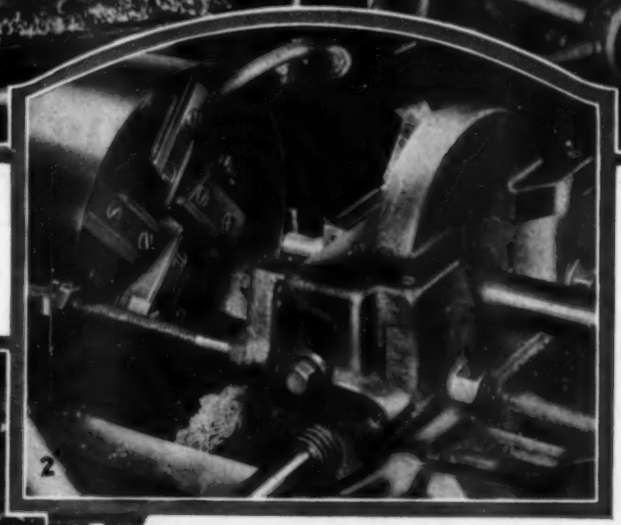
The fifty-five chapters of the book are well developed in textbook form, making easy reading of a difficult subject. It is primarily intended for accountants and cost men, but can be read profitably by any official having general executive responsibilities. Its detailed cross-index makes it a handy reference book on all points pertaining to costs, valuation, or finance.

The book treats in a comprehensive manner of such subjects as financial statements, characteristics of industries, investments, liabilities and reserves, costs of manufacturing, operating statements, and inventories. These subjects are not passed off with general statements, but are analyzed in detail from a practical standpoint.

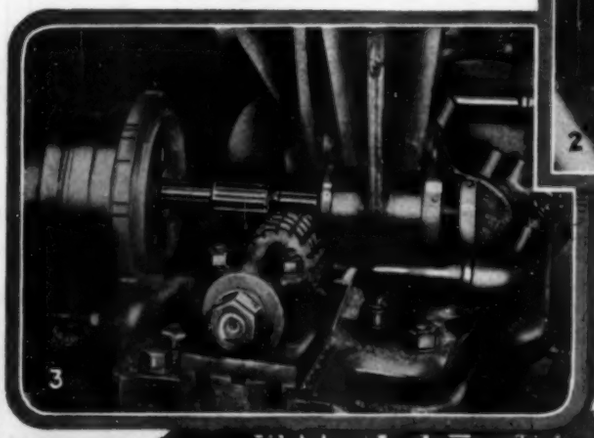
Foremanship. Compiled by Robert H. Spahr. Forty-eight pages, 6x9 in. Published by the Department of Manufacture, Chamber of Commerce, Washington, D. C.

This pamphlet deals with the fundamentals in the development of industrial foremen. It defines the foreman as "the individual of either sex, regardless of title, who represents the connecting link between management and the men or the minor executive who is next in line to the working force." It is a survey of foremen training in the United States gathered from many sources and given in as impartial a manner as possible. There are 15 sections, dealing with the various phases of the subject in a very concise manner. Many practical suggestions are given that can hardly fail to be of value to all who are interested in foreman training—and who is not?





Four Driving-Axle Operations



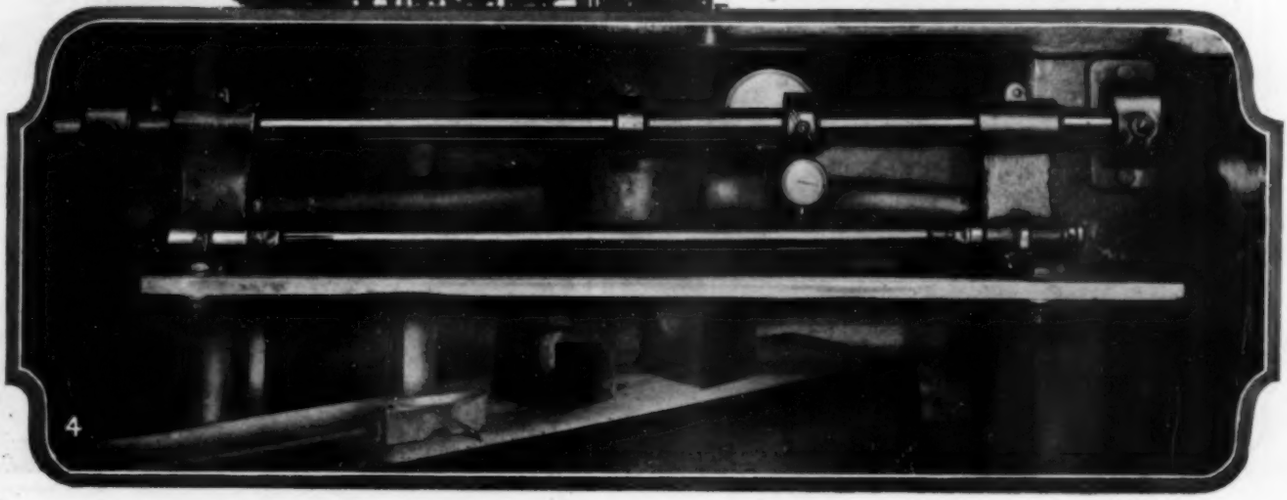
1—Turning in Lo-Swing lathe

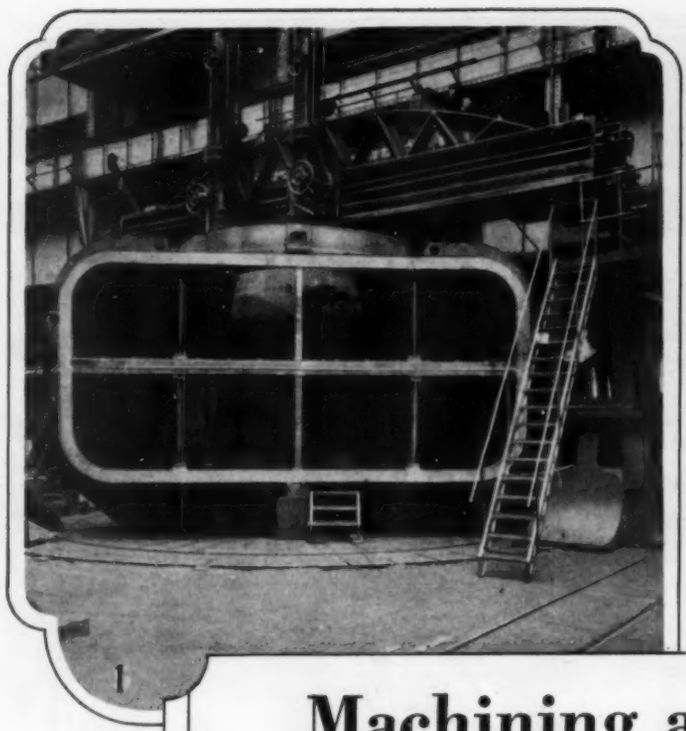
2—Threading on a Landis machine

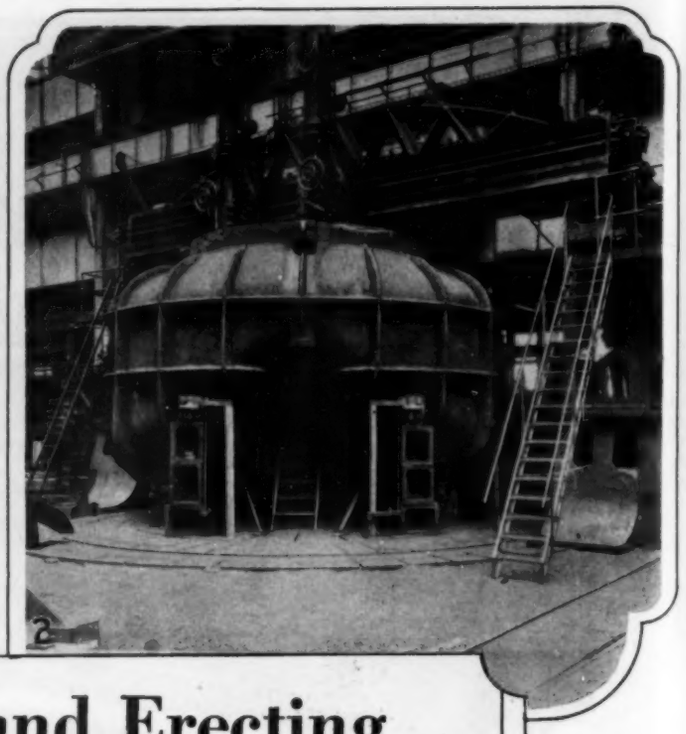
3—Splining in Barber-Colman hobber

4—Straightening on a Lucas press, after heat-treating

Photographs by courtesy of the Cleveland Automobile Co.







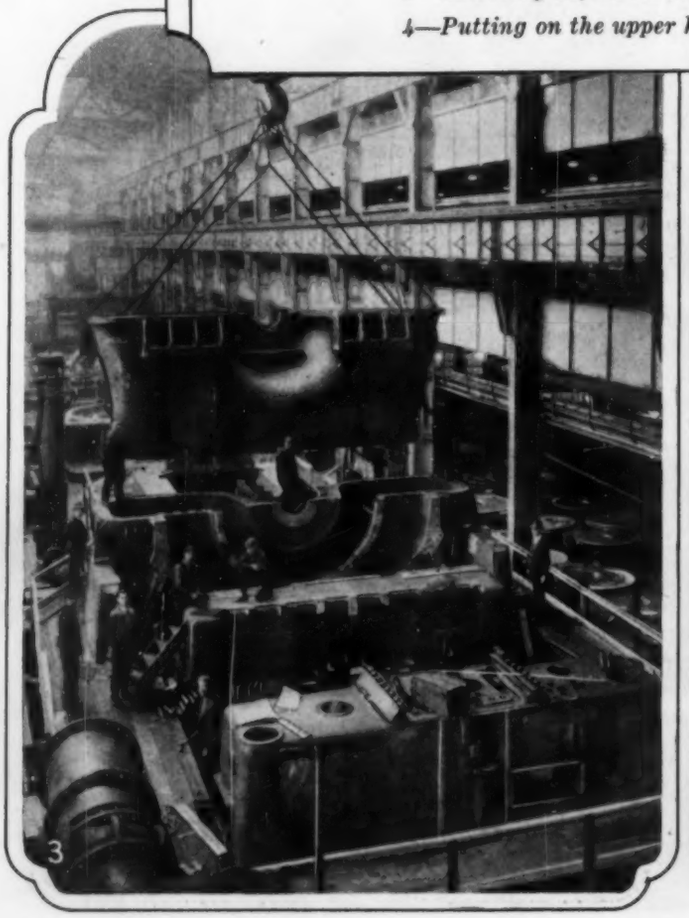
Machining and Erecting Large Turbines

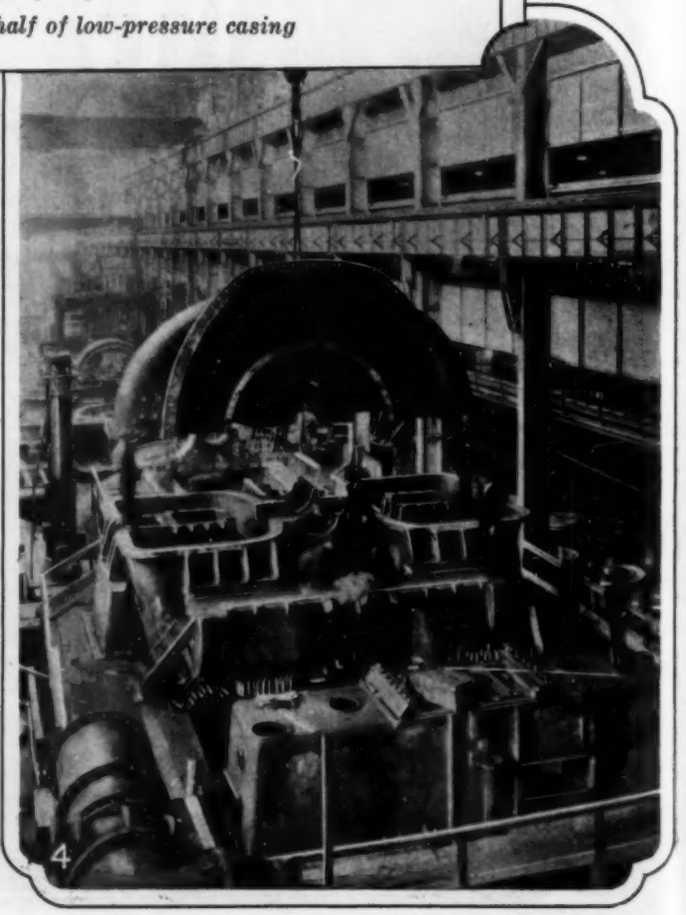
1—Boring exhaust hood for 60,000-kw. turbine

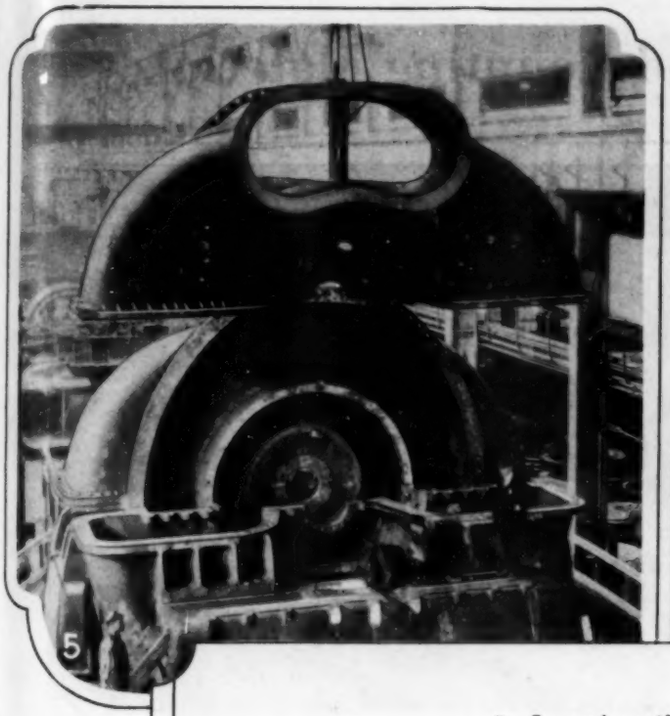
2—Another view of same hood

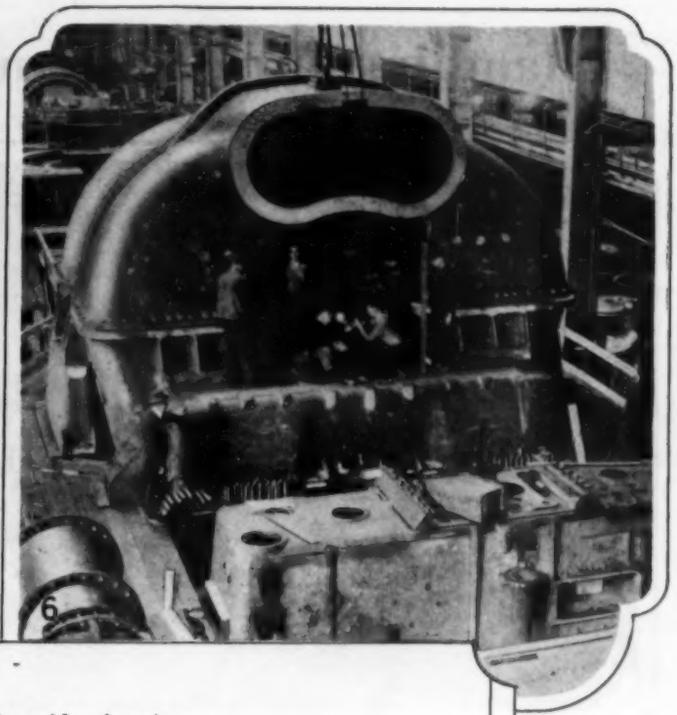
3—Lowering 68,000-lb. casing in place

4—Putting on the upper half of low-pressure casing









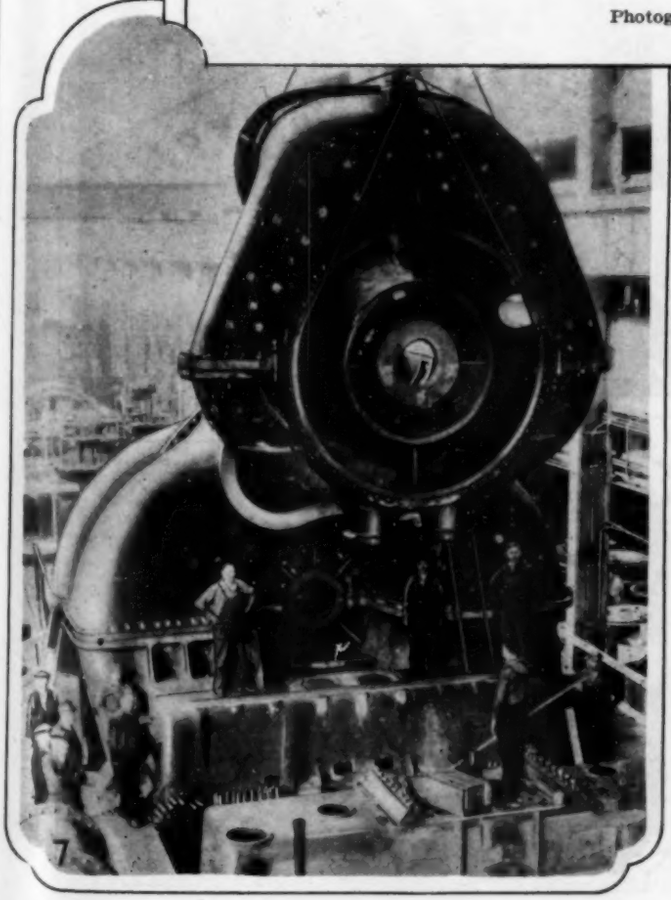
5—Lowering other side of casing

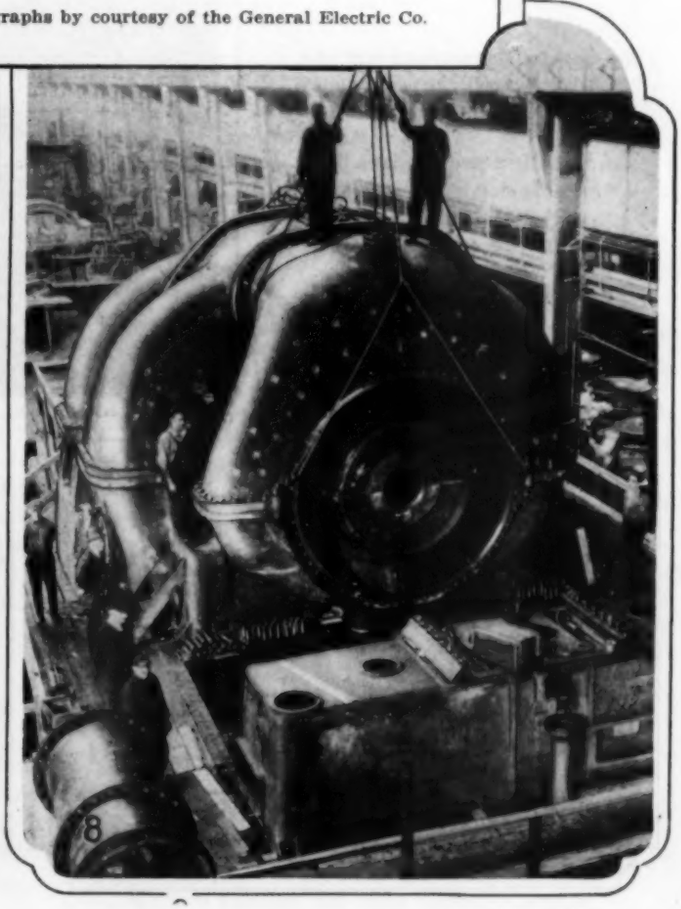
6—Bolting it in place

7—High-pressure casing

8—High-pressure casing in place

Photographs by courtesy of the General Electric Co.





Handling, Weighing and Counting Materials

1—Truck pulls trailers around a horseshoe curve—Cowan

2—Computing scales count the parts on the conveyors —National Scale

3—Machines are easily moved —Cowan

4—Weighing work in transit —National Scale

The Design of Gear Tooth Forms

By Earle Buckingham

Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

A study of contact and sliding conditions on mating gears of the range-cutter, proportional center distance system — Comparison with similar gears of the variable center distance system

A TABLE has been prepared that gives the outside radius of the pinion, the pressure angle of the basic rack cutter to be employed, and the outside radius of the gear for combinations of pinions of from ten to forty-five teeth meshing with gears of from ten to forty-five teeth, 1 diametral pitch, of the range-cutter, proportional center distance system. It is not necessary to extend Table XIV further because the conditions remain constant beyond it.

The center distance for any pair of gears is equal to one-half the sum of the number of teeth in both gears. The tooth depth is constant for any given pressure angle. The tooth depths for each pressure angle are tabulated at the bottom of the table. Dimensions for any pair can be readily determined. As an example we will take a 20-tooth pinion that is to mesh with a 35-tooth gear. From the table we get:

	Number of teeth	20	35
	Outside radius	11.300 in.	18.200 in.
	Pressure angle	20 deg.	
	Tooth depth	2.200 in.	
Whence	Root radius	9.100 in.	16.000 in.

We also know that the center distance is equal to one-half of the sum of the tooth numbers, whence

Center distance 27.500 in.

These dimensions are for gears of 1 diametral pitch. For gears of any other pitch, these figures would be divided by the diametral pitch desired.

As a second example we will take a set of gears that is beyond the tabulated pairs; that is, a 12-tooth pinion that meshes with a 72-tooth gear. We find from the table that the maximum outside radius of the 12-tooth pinion is 7.500 in., and that the pressure angle is 20 deg. The addendum of this pinion has been *increased* 0.500 in. and hence the addendum of its mating gear must be *decreased* the same amount, with the result that the outside radius of the 72-tooth gear will be 36.500 in. Thus we have for this pair:

Number of teeth	12	72
Outside radius	7.500 in.	36.500 in.
Root radius	5.300 in.	34.300 in.
Pressure angle	20 deg.	
Center distance	42.000 in.	

We will now make a brief analysis of this system to insure that we have retained favorable contact conditions. This analysis should show a fairly close approach to the variable center distance system, because that system has been used as a guide in establishing the general proportions of the gears in this proportional center distance system. We will confine this analysis to those pairs that contain the 10-tooth pinion, because the most unfavorable conditions will exist on these 10-tooth pinion drives.

The first example will be a pair of 10-tooth pinions.

N = number of teeth = 10
E = outside radius = 5.8000 in.
R = 25-deg. pitch radius = 5.0000 in.
F = addendum of basic rack-form cutter including clearance = 1.0000 in.
f = clearance = 0.2000 in.
H = root radius = 4.0000 in.
α = pressure angle of cutter and gears = 25 deg.
A = minimum root radius without undercut
a = radius of base circle
Pn = normal pitch.

$a = R\cos\alpha = 4.5316$ in. [Equation (55), eighth article]

$A = R\cos^2\alpha - f = 3.9070$ in. [Equation (60), eighth article]

This pinion is not undercut, as the root radius is outside of the undercut limit.

The next step is to determine the thickness of the tooth at the tip, to make sure that the tooth is not pointed. We have from Problem 6, seventh article,

$$\cos\alpha_2 = \frac{r_1\cos\alpha_1}{r_2} \qquad \text{[Equation (39)]}$$

$$T_2 = 2r_2\left(\frac{T_1}{2r_1} + \operatorname{inv}\alpha_1 - \operatorname{inv}\alpha_2\right) \qquad \text{[Equation (40)]}$$

In this example, $r_1 = 5.0000$ in.
$r_2 = 5.8000$ in.
$T_1 = 1.5708$ in.
$\alpha_1 = 25°$

Whence $\cos\alpha_2 = 0.78130$ and $\alpha_2 = 38° 37'$

$\operatorname{inv}\alpha_2 = 0.12478$

whence $T_2 = 0.7224$ in. $\doteq$ thickness at tip.

We will now examine the contact conditions between these two 10-tooth pinions. We have from the equation (22) in the fifth article:

Number of teeth in contact =

$$\frac{\sqrt{E_1^2 - a_1^2} + \sqrt{E_2^2 - a_2^2} - C\sin\alpha}{Pn}$$

In this example both gears are alike.

$\sqrt{E^2 - a^2} = 3.6201$
$C\sin\alpha = 4.2262$
$Pn = 2.8473$ in.

Whence contact = 1.058 tooth intervals.

The eighteenth article. The nineteenth will appear in an early issue.

This contact is a little greater than on the similar pair of variable center distance gears.

An examination of the specific sliding conditions shows the following:

Max. radius of curvature of active profile	3.6201 in.
Min. radius of curvature of active profile	0.6061 in.
Specific sliding, addendum	+0.83
Specific sliding, dedendum	—4.98

This specific sliding is but slightly greater than on the similar pair of variable center distance gears. These gears approximate very closely, in all respects, variable center distance gears.

We will now examine a 10-tooth pinion that meshes with a 21-tooth gear. This is the last gear in this series that employs a 25-deg. cutter. We have for these gears:

Number of teeth	$N_1 = 10$	$N_2 = 21$
Outside radius	$E_1 =$ 6.0200 in.	$E_2 =$ 11.0800 in.
Root radius	$H_1 =$ 4.2200 in.	$H_2 =$ 9.2800 in.
Base circle radius	$a_1 =$ 4.5316 in.	$a_2 =$ 9.5163 in.
Pressure angle	$a = 25°$	
Normal pitch	$Pn =$ 2.8473 in.	
Center distance	$C =$ 15.5000 in.	

Calculating as before, we get:

Thickness at tip of 10-tooth pinion tooth = 0.6221 in.

Contact = 1.080 tooth intervals

Number of teeth	10	21
Maximum radius of curvature of active profile	3.9619 in.	5.6752 in.
Minimum radius of curvature of active profile	0.7859 in.	2.5887 in.
Specific sliding, addendum	+0.68	+0.67
Specific sliding, dedendum	—2.08	—2.21

The contact on this pair is slightly less than on the same combination of variable center distance gears. The sliding conditions are favorable and well balanced. Hence this pair also approximates a similar pair of variable center distance gears.

We will now examine the conditions that exist when a 10-tooth opinion meshes with a 22-tooth gear. This is the first pair in this series that employs a 22½-deg. cutter. We have for these gears:

Number of teeth	$N_1 = 10$	$N_2 = 22$
Outside radius	$E_1 =$ 6.1400 in.	$E_2 =$ 11.6600 in.
Pitch radius	$R_1 =$ 5.0000 in.	$R_2 =$ 11.0000 in.
Root radius	$H_1 =$ 4.1400 in.	$H_2 =$ 9.6600 in.
Undercut radius	$A_1 =$ 4.0678 in.	$A_2 =$ 9.3891 in.
Radius of base circle	$a_1 =$ 4.6194 in.	$a_2 =$ 10.1627 in.
Pressure angle	$a = 22° - 30'$	
Normal pitch	$Pn =$ 2.9025 in.	
Center distance	$C =$ 16.0000 in.	

Calculating as before, we get:

Thickness at tip of 10-tooth pinion tooth = 0.5171 in.

Contact = 1.253 tooth intervals

Number of teeth	10	22
Maximum radius of curvature of active profile	4.0448 in.	5.7162 in.
Minimum radius of curvature of active profile	0.4067 in.	2.0781 in.
Specific sliding, addendum	+0.76	+0.84
Specific sliding, dedendum	—5.39	—3.28

This pair is a fairly close approximation to the same combination of variable center distance gears. The contact is greater, but the sliding conditions are not as well balanced.

We will take as the next example, a 10-tooth pinion that meshes with a 31-tooth gear. This is the last pair in this series that employs a 22½-deg. cutter. For these gears we have the following values:

Number of teeth	$N_1 = 10$	$N_2 = 31$
Outside radius	$E_1 =$ 6.3200 in.	$E_2 =$ 15.9800 in.
Pitch radius	$R_1 =$ 5.0000 in.	$R_2 =$ 15.5000 in.
Root radius	$H_1 =$ 4.3200 in.	$H_2 =$ 13.9800 in.
Radius of base circle	$a_1 =$ 4.6194 in.	$a_2 =$ 14.3201 in.
Pressure angle	$a = 22° - 30'$	
Normal pitch	$Pn =$ 2.9025 in.	
Center distance	$C =$ 20.5000 in.	

Calculating as before, we get:

Thickness at tip of 10-tooth pinion tooth = 0.4995 in.

Contact = 1.226 tooth intervals

Number of teeth	10	31
Maximum radius of curvature of active profile	4.3132 in.	7.0918 in.
Minimum radius of curvature of active profile	0.7531 in.	3.5317 in.
Specific sliding, addendum	+0.73	+0.67
Specific sliding, dedendum	—2.04	—2.78

This pair is also a very close approximation to the same combination of variable center distance gears. The contact is slightly less, but the sliding conditions are favorable and very well balanced.

We will now examine the conditions that exist when a 10-tooth pinion meshes with a 32-tooth gear, since this is the first pair in this series that employs a 20-deg. cutter. We have for these gears:

Number of teeth	$N_1 = 10$	$N_2 = 32$
Outside radius	$E_1 =$ 6.4400 in.	$E_2 =$ 16.5600 in.
Pitch radius	$R_1 =$ 5.0000 in.	$R_2 =$ 16.0000.in.
Root radius	$H_1 =$ 4.2400 in.	$H_2 =$ 14.3600 in.
Undercut radius	$A_1 =$ 4.2151 in.	$A_2 =$ 13.9283 in.
Radius of base circle	$a_1 =$ 4.6985 in.	$a_2 =$ 15.0350 in.
Pressure angle	$a = 20°$	
Normal pitch	$Pn =$ 2.9521 in.	
Center distance	$C =$ 21.0000 in.	

Calculating as before, we get:

Thickness of tip of 10-tooth pinion tooth = 0.2537 in.

Contact = 1.410 tooth intervals

Number of teeth	10	32
Maximum radius of curvature of active profile	4.4043 in.	6.9412 in.
Minimum radius of curvature of active profile	0.2412 in.	2.7781 in.
Specific sliding, addendum	+0.80	+0.88
Specific sliding, dedendum	—7.99	—4.07

The contact on this pair is considerably greater than on the similar pair of variable center distance gears, but the specific sliding is greater and not as well balanced. The additional contact has been obtained at the expense of more sensitive tooth profiles. This pair departs more from the variable center distance gears than any other pair of the series. It is a reasonably close approximation to them however.

Table XIV—Outside Radii and Pressure Angles of the Range-Cutter, Proportional Center Distance System, 1-D.P. Gears

	No. of Teeth in Gear	Number of Teeth in Pinion											
		10	11	12	13	14	15	16	17	18	19	20	21
E_1 α E_2	10	5.800 25° 5.800											
E_1 α E_2	11	5.820 25° 6.280	6.300 25° 6.300										
E_1 α E_2	12	5.840 25° 6.760	6.320 25° 6.780	6.800 25° 6.800									
E_1 α E_2	13	5.860 25° 7.240	6.340 25° 7.260	6.820 25° 7.280	7.300 25° 7.300								
E_1 α E_2	14	5.880 25° 7.720	6.360 25° 7.740	6.840 25° 7.760	7.320 25° 7.780	7.800 25° 7.800							
E_1 α E_2	15	5.900 25° 8.200	6.380 25° 8.220	6.860 25° 8.240	7.340 25° 8.260	7.820 25° 8.280	8.300 25° 8.300						
E_1 α E_2	16	5.920 25° 8.680	6.400 25° 8.700	6.880 25° 8.720	7.360 25° 8.740	7.840 25° 8.760	8.320 25° 8.780	8.900 22°–30′ 8.900					
E_1 α E_2	17	5.940 25° 9.160	6.420 25° 9.180	6.900 25° 9.200	7.380 25° 9.220	7.860 25° 9.240	8.440 22°–30′ 9.360	8.920 22°–30′ 9.380	9.400 22°–30′ 9.400				
E_1 α E_2	18	5.960 25° 9.640	6.440 25° 9.660	6.920 25° 9.680	7.400 25° 9.700	7.980 22°–30′ 9.820	8.460 22°–30′ 9.840	8.940 22°–30′ 9.860	9.420 22°–30′ 9.880	9.900 22°–30′ 9.900			
E_1 α E_2	19	5.980 25° 10.120	6.460 25° 10.140	6.940 25° 10.160	7.520 22°–30′ 10.280	8.000 22°–30′ 10.300	8.480 22°–30′ 10.320	8.960 22°–30′ 10.340	9.440 22°–30′ 10.360	9.920 22°–30′ 10.380	10.400 22°–30′ 10.400		
E_1 α E_2	20	6.000 25° 10.600	6.480 25° 10.620	7.060 22°–30′ 10.740	7.540 22°–30′ 10.760	8.020 22°–30′ 10.780	8.500 22°–30′ 10.800	8.980 22°–30′ 10.820	9.460 22°–30′ 10.840	9.940 22°–30′ 10.860	10.420 22°–30′ 10.880	10.900 22°–30′ 10.900	
E_1 α E_2	21	6.020 25° 11.080	6.600 22°–30′ 11.200	7.080 22°–30′ 11.220	7.560 22°–30′ 11.240	8.040 22°–30′ 11.260	8.520 22°–30′ 11.280	9.000 22°–30′ 11.300	9.480 22°–30′ 11.320	9.960 22°–30′ 11.340	10.440 22°–30′ 11.360	10.920 22°–30′ 11.380	11.500 20° 11.500
E_1 α E_2	22	6.140 22°–30′ 11.660	6.620 22°–30′ 11.680	7.100 22°–30′ 11.700	7.580 22°–30′ 11.720	8.060 22°–30′ 11.740	8.540 22°–30′ 11.760	9.020 22°–30′ 11.780	9.500 22°–30′ 11.800	9.980 22°–30′ 11.820	10.460 22°–30′ 11.840	11.040 20° 11.960	11.520 20° 11.980
E_1 α E_2	23	6.160 22°–30′ 12.140	6.640 22°–30′ 12.160	7.120 22°–30′ 12.180	7.600 22°–30′ 12.200	8.080 22°–30′ 12.220	8.560 22°–30′ 12.240	9.040 22°–30′ 12.260	9.520 22°–30′ 12.280	10.000 22°–30′ 12.300	10.580 20° 12.420	11.060 20° 12.440	11.540 20° 12.460
E_1 α E_2	24	6.180 22°–30′ 12.620	6.660 22°–30′ 12.640	7.140 22°–30′ 12.660	7.620 22°–30′ 12.680	8.100 22°–30′ 12.700	8.580 22°–30′ 12.720	9.060 22°–30′ 12.740	9.540 22°–30′ 12.760	10.120 20° 12.880	10.600 20° 12.900	11.080 20° 12.920	11.560 20° 12.940
E_1 α E_2	25	6.200 22°–30′ 13.100	6.680 22°–30′ 13.120	7.160 22°–30′ 13.140	7.640 22°–30′ 13.160	8.120 22°–30′ 13.180	8.600 22°–30′ 13.200	9.080 22°–30′ 13.220	9.660 20° 13.340	10.140 20° 13.360	10.620 20° 13.380	11.100 20° 13.400	11.580 20° 13.420
E_1 α E_2	26	6.220 22°–30′ 13.580	6.700 22°–30′ 13.600	7.180 22°–30′ 13.620	7.660 22°–30′ 13.640	8.140 22°–30′ 13.660	8.620 22°–30′ 13.680	9.200 20° 13.800	9.680 20° 13.820	10.160 20° 13.840	10.640 20° 13.860	11.120 20° 13.880	11.600 20° 13.900
E_1 α E_2	27	6.240 22°–30′ 14.060	6.720 22°–30′ 14.080	7.200 22°–30′ 14.100	7.680 22°–30′ 14.120	8.160 22°–30′ 14.140	8.740 20° 14.260	9.220 20° 14.280	9.700 20° 14.300	10.180 20° 14.320	10.660 20° 14.340	11.140 20° 14.360	11.620 20° 14.380
E_1 α E_2	28	6.260 22°–30′ 14.540	6.740 22°–30′ 14.560	7.220 22°–30′ 14.580	7.700 22°–30′ 14.600	8.280 20° 14.720	8.760 20° 14.740	9.240 20° 14.760	9.720 20° 14.780	10.200 20° 14.800	10.680 20° 14.820	11.160 20° 14.840	11.640 20° 14.860

Legend: E_1 = Outside radius of pinion, in. α = Pressure angle of basic rack. E_2 = Outside radius of gear, in.
The working depths vary with the pressure angles as follows:

Pressure Angle:	25°	22°–30′	20°	17°	14°–30′
Working Depth:	1.800 in.	2.000 in.	2.200 in.	2.200 in.	2.200 in

Table XIV (Continued)—Outside Radii and Pressure Angles of the Range-Cutter, Proportional Center Distance System, 1-D.P. Gears

	No. of Teeth in Gear	Number of Teeth in Pinion											
		10	11	12	13	14	15	16	17	18	19	20	21
E_1 α E_2	29	6.280 22°–30′ 15.020	6.760 22°–30′ 15.040	7.240 22°–30′ 15.060	7.820 20° 15.180	8.300 20° 15.200	8.780 20° 15.220	9.260 20° 15.240	9.740 20° 15.260	10.220 20° 15.280	10.700 20° 15.300	11.180 20° 15.320	11.660 20° 15.340
E_1 α E_2	30	6.300 22°–30′ 15.500	6.780 22°–30′ 15.520	7.360 20° 15.640	7.840 20° 15.660	8.320 20° 15.680	8.800 20° 15.700	9.280 20° 15.720	9.760 20° 15.740	10.240 20° 15.760	10.720 20° 15.780	11.200 20° 15.800	11.680 20° 15.820
E_1 α E_2	31	6.320 22°–30′ 15.980	6.900 20° 16.100	7.380 20° 16.120	7.860 20° 16.140	8.340 20° 16.160	8.820 20° 16.180	9.300 20° 16.200	9.780 20° 16.220	10.260 20° 16.240	10.740 20° 16.260	11.220 20° 16.280	11.700 20° 16.300
E_1 α E_2	32	6.440 20° 16.560	6.920 20° 16.580	7.400 20° 16.600	7.880 20° 16.620	8.360 20° 16.640	8.840 20° 16.660	9.320 20° 16.680	9.800 20° 16.700	10.280 20° 16.720	10.760 20° 16.740	11.240 20° 16.760	11.720 20° 16.780
E_1 α E_2	33	6.460 20° 17.040	6.940 20° 17.060	7.420 20° 17.080	7.900 20° 17.100	8.380 20° 17.120	8.860 20° 17.140	9.340 20° 17.160	9.820 20° 17.180	10.300 20° 17.200	10.780 20° 17.220	11.260 20° 17.240	11.740 20° 17.260
E_1 α E_2	34	6.480 20° 17.520	6.960 20° 17.540	7.440 20° 17.560	7.920 20° 17.580	8.400 20° 17.600	8.880 20° 17.620	9.360 20° 17.640	9.840 20° 17.660	10.320 20° 17.680	10.800 20° 17.700	11.280 20° 17.720	11.760 20° 17.740
E_1 α E_2	35	6.500 20° 18.000	6.980 20° 18.020	7.460 20° 18.040	7.940 20° 18.060	8.420 20° 18.080	8.900 20° 18.100	9.380 20° 18.120	9.860 20° 18.140	10.340 20° 18.160	10.820 20° 18.180	11.300 20° 18.200	11.780 20° 18.220
E_1 α E_2	36	6.500 20° 18.500	7.000 20° 18.500	7.480 20° 18.520	7.960 20° 18.540	8.440 20° 18.560	8.920 20° 18.580	9.400 20° 18.600	9.880 20° 18.620	10.360 20° 18.640	10.840 20° 18.660	11.320 20° 18.680	11.800 20° 18.700
E_1 α E_2	37	6.500 20° 19.000	7.000 20° 19.000	7.500 20° 19.000	7.980 20° 19.020	8.460 20° 19.040	8.940 20° 19.060	9.420 20° 19.080	9.900 20° 19.100	10.380 20° 19.120	10.860 20° 19.140	11.340 20° 19.160	11.820 20° 19.180
E_1 α E_2	38	6.500 20° 19.500	7.000 20° 19.500	7.500 20° 19.500	8.000 20° 19.500	8.480 20° 19.520	8.960 20° 19.540	9.440 20° 19.560	9.920 20° 19.580	10.400 20° 19.600	10.880 20° 19.620	11.360 20° 19.640	11.840 20° 19.660
E_1 α E_2	39	6.500 20° 20.000	7.000 20° 20.000	7.500 20° 20.000	8.000 20° 20.000	8.500 20° 20.000	8.980 20° 20.020	9.460 20° 20.040	9.940 20° 20.060	10.420 20° 20.080	10.900 20° 20.100	11.380 20° 20.120	11.860 17° 20.140
E_1 α E_2	40	6.500 20° 20.500	7.000 20° 20.500	7.500 20° 20.500	8.000 20° 20.500	8.500 20° 20.500	9.000 20° 20.500	9.480 20° 20.520	9.960 20° 20.540	10.440 20° 20.560	10.920 20° 20.580	11.400 17° 20.600	11.880 17° 20.620
E_1 α E_2	41	6.500 20° 21.000	7.000 20° 21.000	7.500 20° 21.000	8.000 20° 21.000	8.500 20° 21.000	9.000 20° 21.000	9.480 20° 21.020	9.960 20° 21.040	10.440 20° 21.060	10.920 20° 21.080	11.400 17° 21.100	11.880 17° 21.120
E_1 α E_2	42	6.500 20° 21.500	7.000 20° 21.500	7.500 20° 21.500	8.000 20° 21.500	8.500 20° 21.500	9.000 20° 21.500	9.480 20° 21.520	9.960 20° 21.540	10.440 20° 21.560	10.920 20° 21.580	11.400 17° 21.600	11.880 17° 21.620
E_1 α E_2	43	6.500 20° 22.000	7.000 20° 22.000	7.500 20° 22.000	8.000 20° 22.000	8.500 20° 22.000	9.000 20° 22.000	9.480 20° 22.020	9.960 20° 22.040	10.440 20° 22.060	10.920 20° 22.080	11.400 17° 22.100	11.880 17° 22.120
E_1 α E_1	44	6.500 20° 22.500	7.000 20° 22.500	7.500 20° 22.500	8.000 20° 22.500	8.500 20° 22.500	9.000 20° 22.500	9.480 20° 22.520	9.960 20° 22.540	10.440 20° 22.560	10.920 20° 22.580	11.400 17° 22.600	11.880 17° 22.620
E_1 α E_2	45	6.500 20° 23.000	7.000 20° 23.000	7.500 20° 23.000	8.000 20° 23.000	8.500 20° 23.000	9.000 20° 23.000	9.480 20° 23.020	9.960 20° 23.040	10.440 20° 23.060	10.920 20° 23.080	11.400 17° 23.100	11.880 17° 23.120
		22	23	24	25	26	27	28	29	30	31	32	33
E_1 α E_2	22	12.000 20° 12.000											
E_1 α E_2	23	12.020 20° 12.480	12.500 20° 12.500										

Legend: E_1 = Outside radius of pinion, in. α = Pressure angle of basic rack. E_2 = Outside radius of gear, in. The working depths vary with the pressure angles as follows:

Pressure Angle:	25°	22°–30′	20°	17°	14°–30′
Working Depth:	1.800 in.	2.000 in.	2.200 in.	2.200 in.	2.200 in.

Table XIV (Continued)—Outside Radii and Pressure Angles of the Range-Cutter, Proportional Center Distance System, 1-D.P. Gears

	No. of Teeth in Gear	Number of Teeth in Pinion											
		22	23	24	25	26	27	28	29	30	31	32	33
E_1 α E_2	24	12.040 20° 12.960	12.520 20° 12.980	13.000 20° 13.000									
E_1 α E_2	25	12.060 20° 13.440	12.540 20° 13.460	13.020 20° 13.480	13.500 20° 13.500								
E_1 α E_2	26	12.080 20° 13.920	12.560 20° 13.940	13.040 20° 13.960	13.520 20° 13.980	14.000 20° 14.000							
E_1 α E_2	27	12.100 20° 14.400	12.580 20° 14.420	13.060 20° 14.440	13.540 20° 14.460	14.020 20° 14.480	14.500 20° 14.500						
E_1 α E_2	28	12.120 20° 14.880	12.600 20° 14.900	13.080 20° 14.920	13.560 20° 14.940	14.040 20° 14.960	14.520 20° 14.980	15.000 20° 15.000					
E_1 α E_2	29	12.140 20° 15.360	12.620 20° 15.380	13.100 20° 15.400	13.580 20° 15.420	14.060 20° 15.440	14.540 20° 15.460	15.020 20° 15.480	15.500 20° 15.500				
E_1 α E_2	30	12.160 20° 15.840	12.640 20° 15.860	13.120 20° 15.880	13.600 20° 15.900	14.080 20° 15.920	14.560 20° 15.940	15.040 20° 15.960	15.520 20° 15.980	16.000 17° 16.000			
E_1 α E_2	31	12.180 20° 16.320	12.660 20° 16.340	13.140 20° 16.360	13.620 20° 16.380	14.100 20° 16.400	14.580 20° 16.420	15.060 20° 16.440	15.540 17° 16.460	16.020 17° 16.480	16.500 17° 16.500		
E_1 α E_2	32	12.200 20° 16.800	12.680 20° 16.820	13.160 20° 16.840	13.640 20° 16.860	14.120 20° 16.880	14.600 20° 16.900	15.080 17° 16.920	15.560 17° 16.940	16.040 17° 16.960	16.520 17° 16.980	17.000 17° 17.000	
E_1 α E_2	33	12.220 20° 17.280	12.700 20° 17.300	13.180 20° 17.320	13.660 20° 17.340	14.140 20° 17.360	14.620 17° 17.380	15.100 17° 17.400	15.580 17° 17.420	16.060 17° 17.440	16.540 17° 17.460	17.020 17° 17.480	17.500 17° 17.500
E_1 α E_2	34	12.240 20° 17.760	12.720 20° 17.780	13.200 20° 17.800	13.680 20° 17.820	14.160 17° 17.840	14.640 17° 17.860	15.120 17° 17.880	15.600 17° 17.900	16.080 17° 17.920	16.560 17° 17.940	17.040 17° 17.960	17.520 17° 17.980
E_1 α E_2	35	12.260 20° 18.240	12.740 20° 18.260	13.220 20° 18.280	13.700 17° 18.300	14.180 17° 18.320	14.660 17° 18.340	15.140 17° 18.360	15.620 17° 18.380	16.100 17° 18.400	16.580 17° 18.420	17.060 17° 18.440	17.540 17° 18.460
E_1 α E_2	36	12.280 20° 18.720	12.760 20° 18.740	13.240 17° 18.760	13.720 17° 18.780	14.200 17° 18.800	14.680 17° 18.820	15.160 17° 18.840	15.640 17° 18.860	16.120 17° 18.880	16.600 17° 18.900	17.080 17° 18.920	17.560 17° 18.940
E_1 α E_2	37	12.300 20° 19.200	12.780 17° 19.220	13.260 17° 19.240	13.740 17° 19.260	14.220 17° 19.280	14.700 17° 19.300	15.180 17° 19.320	15.660 17° 19.340	16.140 17° 19.360	16.620 17° 19.380	17.100 17° 19.400	17.580 17° 19.420
E_1 α E_2	38	12.320 17° 19.680	12.800 17° 19.700	13.280 17° 19.720	13.760 17° 19.740	14.240 17° 19.760	14.720 17° 19.780	15.200 17° 19.800	15.680 17° 19.820	16.160 17° 19.840	16.640 17° 19.860	17.120 17° 19.880	17.600 17° 19.900
E_1 α E_2	39	12.340 17° 20.160	12.820 17° 20.180	13.300 17° 20.200	13.780 17° 20.220	14.260 17° 20.240	14.740 17° 20.260	15.220 17° 20.280	15.700 17° 20.300	16.180 17° 20.320	16.660 17° 20.340	17.140 17° 20.360	17.620 17° 20.380
E_1 α E_2	40	12.360 17° 20.640	12.840 17° 20.660	13.320 17° 20.680	13.800 17° 20.700	14.280 17° 20.720	14.760 17° 20.740	15.240 17° 20.760	15.720 17° 20.780	16.200 17° 20.800	16.680 17° 20.820	17.160 17° 20.840	17.640 17° 20.860
E_1 α E_2	41	12.360 17° 21.140	12.840 17° 21.160	13.320 17° 21.180	13.800 17° 21.200	14.280 17° 21.220	14.760 17° 21.240	15.240 17° 21.260	15.720 17° 21.280	16.200 17° 21.300	16.680 17° 21.320	17.160 17° 21.340	17.640 17° 21.360
E_1 α E_2	42	12.360 17° 21.640	12.840 17° 21.660	13.320 17° 21.680	13.800 17° 21.700	14.280 17° 21.720	14.760 17° 21.740	15.240 17° 21.760	15.720 17° 21.780	16.200 17° 21.800	16.680 17° 21.820	17.160 17° 21.840	17.640 17° 21.860

Legend: E_1 = Outside radius of pinion, in. α = Pressure angle of basic rack. E_2 = Outside radius of gear, in. The working depths vary with the pressure angles as follows:

Pressure Angle:	25°	22°–30′	20°	17°	14°–30′
Working Depth:	1.800 in.	2.000 in.	2.200 in.	2.200 in.	2.200 in.

Table XIV (Continued)—Outside Radii and Pressure Angles of the Range-Cutter, Proportional Center Distance System, 1-D.P. Gears

	No. of Teeth in Gear	Number of Teeth in Pinion											
		22	23	24	25	26	27	28	29	30	31	32	33
E_1 α E_2	43	12.360 17° 22.140	12.840 17° 22.160	13.320 17° 22.180	13.800 17° 22.200	14.280 17° 22.220	14.760 17° 22.240	15.240 17° 22.260	15.720 17° 22.280	16.200 17° 22.300	16.680 17° 22.320	17.160 17° 22.340	17.640 17° 22.360
E_1 α E_2	44	12.360 17° 22.640	12.840 17° 22.660	13.320 17° 22.680	13.800 17° 22.700	14.280 17° 22.720	14.760 17° 22.740	15.240 17° 22.760	15.720 17° 22.780	16.200 17° 22.800	16.680 17° 22.820	17.160 17° 22.840	17.640 17° 22.860
E_1 α E_2	45	12.360 17° 23.140	12.840 17° 23.160	13.320 17° 23.180	13.800 17° 23.200	14.280 17° 23.220	14.760 17° 23.240	15.240 17° 23.260	15.720 17° 23.280	16.200 17° 23.300	16.680 17° 23.320	17.160 17° 23.340	17.640 17° 23.360
		34	35	36	37	38	39	40	41	42	43	44	45
E_1 α E_2	34	18.000 17° 18.000											
E_1 α E_1	35	18.020 17° 18.480	18.500 17° 18.500										
E_1 α E_2	36	18.040 17° 18.960	18.520 17° 18.980	19.000 17° 19.000									
E_1 α E_2	37	18.060 17° 19.440	18.540 17° 19.460	19.020 17° 19.480	19.500 17° 19.500								
E_1 α E_2	38	18.080 17° 19.920	18.560 17° 19.940	19.040 17° 19.960	19.520 17° 19.980	20.000 17° 20.000							
E_1 α E_2	39	18.100 17° 20.400	18.580 17° 20.420	19.060 17° 20.440	19.540 17° 20.460	20.020 17° 20.480	20.500 17° 20.500						
E_1 α E_2	40	18.120 17° 20.880	18.600 17° 20.900	19.080 17° 20.920	19.560 17° 20.940	20.040 17° 20.960	20.520 17° 20.980	21.000 14°–30′ 21.000					
E_1 α E_2	41	18.120 17° 21.380	18.600 17° 21.400	19.080 17° 21.420	19.560 17° 21.440	20.040 17° 21.460	20.520 17° 21.480	21.000 14°–30′ 21.500	21.500 14°–30′ 21.500				
E_1 α E_2	42	18.120 17° 21.880	18.600 17° 21.900	19.080 17° 21.920	19.560 17° 21.940	20.040 17° 21.960	20.520 17° 21.980	21.000 14°–30′ 22.000	21.500 14°–30′ 22.000	22.000 14°–30′ 22.000			
E_1 α E_2	43	18.120 17° 22.380	18.600 17° 22.400	19.080 17° 22.420	19.560 17° 22.440	20.040 17° 22.460	20.520 17° 22.480	21.000 14°–30′ 22.500	21.500 14°–30′ 22.500	22.000 14°–30′ 22.500	22.500 14°–30′ 22.500		
E_1 α E_2	44	18.120 17° 22.880	18.600 17° 22.900	19.080 17° 22.920	19.560 17° 22.940	20.040 17° 22.960	20.520 17° 22.980	21.000 14°–30′ 23.000	21.500 14°–30′ 23.000	22.000 14°–30′ 23.000	22.500 14°–30′ 23.000	23.000 14°–30′ 23.000	
E_1 α E_2	45	18.120 17° 23.380	18.600 17° 23.400	19.080 17° 23.420	19.560 17° 23.440	20.040 17° 23.460	20.520 17° 23.480	21.000 14°–30′ 23.500	21.500 14°–30′ 23.500	22.000 14°–30′ 23.500	22.500 14°–30′ 23.500	23.000 14°–30′ 23.500	23.500 14°–30′ 23.500

Legend: E_1 = Outside radius of pinion, in. α = Pressure angle of basic rack. E_2 = Outside radius of gear, in. The working depths vary with the pressure angles as follows:

Pressure Angle:	25°	22°–30′	20°	17°	14°–30′
Working Depth:	1.800 in.	2.000 in.	2.200 in.	2.200 in.	2.200 in.

For the last example in this series, we will examine the conditions that exist between a 10-tooth pinion and its mating 40-tooth gear. For these gears we have the following values:

Number of teeth	$N_1 = 10$	$N_2 = 40$
Outside radius	$E_1 =$ 6.5000 in.	$E_2 =$ 20.5000 in.
Pitch radius	$R_1 =$ 5.0000 in.	$R_2 =$ 20.0000 in.
Root radius	$H_1 =$ 4.3000 in.	$H_2 =$ 18.3000 in.

Radius of base circle $a_1 =$ 4.6985 in. $a_2 =$ 18.7938 in.
Pressure angle $\alpha = 20°$
Normal pitch $Pn =$ 2.9521 in.
Center distance $C =$ 25.0000 in.

Calculating as before, we get:

Thickness of tip of 10-tooth pinion tooth = 0.1976 in.
Contact = 1.398 tooth intervals

Number of teeth	10	40
Maximum radius of curvature of active profile	4.4916 in.	8.1879 in.
Minimum radius of curvature of active profile	0.3626 in.	4.0589 in.
Specific sliding, addendum	+0.77	+0.82
Specific sliding, dedendum	−4.64	−3.42

This pair is a close approximation to the same combination of variable center distance gears. The contact is slightly more and the specific sliding is slightly greater than would be in the latter case, but conditions are reasonably well balanced.

It is not necessary to check any further. The 10-tooth pinion will show the greatest departures from the variable center distance gears of any in the series because it is the smallest of the series, and the smallest gears of any series is always the most sensitive one. This range-cutter, proportional center distance system is a very close approximation in all respects to the variable center distance gears.

Locating a Job—Discussion

BY ENTROPY

The idea that salesmanship is better paid than production crops out once more in the article by George Cormack on page 862, vol. 64, of the *American Machinist*. He finds himself out of work after having passed the dead line of 50 years, looks about, gets little encouragement from shop superintendents, but finds that sales managers are eager for his services.

In many cases the man who goes through the same experience does not make good. He worries along for a time on commissions that do not materialize, finally dropping salesmanship and going back to the shop to take what he can get. There are probably ten who try Mr. Cormack's way and fail to every one who succeeds.

The reason why sales managers encourage a man to try selling is because they do not feel that age determines a man's value in their field, and because they realize that some men go a long way in life without finding out whether they can sell or not. Some sales managers, particularly those that have peculiar ideas of how to sell, want only young men, who can be molded to their way, or rather who will not know any better than to try their way. But the majority of those who have something tangible like machinery to sell prefer men of maturity who look as though they knew something. The great number of high-pressure young fellows who race about the country trying to carry purchasers off their feet by storm, are not adaptable to the sale of machinery.

In fact, good machinery does not need a salesman. Some readers will not agree with me, but I believe that the great majority of men who are in the market for machinery know what they want, are capable of making up their own minds, and do so, with little regard to any line of sales talk which may be put up to them. They want expert opinion, and facts from which they can draw their own conclusions. A mechanic with the ability to make himself thoroughly understood, and who is courageous enough not to overpraise his own goods, can get orders, and that is what manufacturers and their agents want.

Enlarging Gears in Hardening

BY C. U. SCOTT

I RECENTLY had a problem in the carbonizing and hardening of two internal gears which were 26 in. in diameter and 5-in. face. Steel is inclined to get smaller when given the carbonizing and hardening heats. These gears had to be set into a recess, machined and taken out; carbonized and hardened; then ground and pressed into position with three-hundred tons pressure. The problem was to get the gears out and have them large enough to grind and leave sufficient stock to be pressed in the recess after they were hardened.

The customer made up one set of the gears and hardened them but they were so much under size that they would drop into the recess even without grinding. Our problem was to take the gears, carbonize and harden them and have them ten thousandths larger after hardening than they were before. In order to accomplish this, we used the following method:

We had a pattern made for a spur gear with the same number of teeth as was in the internal gear. We machined it as carefully as the original gears were machined, leaving it 0.0140 in. larger than the roots of the teeth on the internal gear. We found that in order to get circulation around the teeth, we would be obliged to make a cooling fixture as well as a sizing gear of the spur gear. We carbonized the gears, allowing them to cool in the carbonizer.

We then placed the internal gears in the furnace and heated them to a hardening temperature of about 1,425 deg. F. We next put them them over the spur gear or cooling fixture. We had so designed the cooling fixture or spur gear so that when we placed the internal gear in position the teeth on the two would come in contact. We were very careful that our heat was uniform throughout in order to have equal contraction. We placed the gears in a tank where they would have a 14-ft. drop in the water. In this way water was forced up between the teeth and the sides were hardened to 80 Sclerescope. The two pieces were shrunk together during the hardening operation, expanding the external gear to about the desired point.

We removed the gears from the cooling bath and placed the entire fixture in the furnace. Having made the fixture extremely heavy, (it weighed over 500 lb.), so it would not take the heat so quickly, we raised the temperature of the furnace very rapidly, suspending both fixture and gear so that the moment sufficient expansion had taken place the gear would drop off the fixture. This was accomplished in a very short time without heating the gear sufficiently to draw the temper, and the gear dropped off 0.004 in. smaller than the fixture. This gear did not remain perfectly round but we were able to straighten it within 0.002 in. by the use of our hydraulic press. The same procedure on the second gear gave similar results, and the seemingly impossible job was accomplished quite easily.

There are many seemingly impossible things that come to the hardening department which can be solved by taking advantage of the natural laws governing the cooling of a piece of steel. We are often able to save a great deal of grinding by forcing a mandrel into a piece after carbonizing and hardening, and again, we save a great deal of grinding by hardening a piece on a mandrel and pressing the mandrel out with hydraulic presses after hardening.

THE · FOREMAN'S · ROUND · TABLE

Where Shall We Start Apprentices?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"THERE'S something sour about the apprentice training, Joe," said Al to the apprentice instructor the other noon. "That new boy seems like a nice sort of a chap but he doesn't appear to know just when he should do a good job and when a loose fit is just as good."

"Gee whiz, Al, do you expect a boy to have good judgment in such things? I'll bet you've got men in your department who wouldn't get first prize for horse sense, either. Why pick on the boy?"

"You're right about the men, Joe, but some of them never had much training. Whatever they know they've picked up as they could. We're training boys to make good mechanics out of 'em—to give 'em a foundation that the 'pick-up' mechanics haven't got. And somehow you're not doing it with the boys. Better think it over."

"I don't just see how I can put horse sense into the course, under that heading, anyhow, Al. I believe it's a good course now. We start the boys on simple work such as drilling, cutting bolts and doing jobs of that kind. Then we shift them to lathe and boring mill work, milling and so on up to the erecting floor. Can you beat that, Al?"

"Well, Joe, if I didn't get results that way I'd try some other. How does the boy know about the different kinds of fits? Can't know much about them till he gets to the assembly of parts—either in sub-assembly or erecting the whole machine."

"How else can he do it? That's the regular way of all courses, Al."

"Then I'd try a new one, Joe. Why not start the boys in the erecting department with a good man? Then they could see just where every piece went and learn why one part had to be a good fit and another could be loose. They'd learn the names of parts at the same time. Then when they came to tackle the lathe and miller they'd know what kind of a job had to be done to get by in the erecting of the machine. They'd know what to call pieces so we knew what they meant."

"That don't sound so good to me, Al. Sort of putting the cart before the horse, though I have heard that it's being done. But I guess it's better to stick to the old way. We've made some pretty good mechanics in the old way. Want to give them a solid background, Al."

"The more I think of it, Joe, the better I like my scheme. I'll bet you'd find more boys would like the job and stick if you started in at the other end. They get darn sick of running a bolt cutter and doing dirty jobs before they know about the rest of the work. Show 'em what a real job is at the start and they'd be more apt to stick it through."

Have you ever known Al's Plan to be tried? How did it work?
Was Joe right in believing the old way is best?
Will the boys be more apt to stick if they are shown the whole machine and what it does soon after they start?
Is Al right in thinking that the boys will be more interested if they know more about the machines they are to build?

All foremen are urged to discuss these questions from their own experience. Acceptable letters will be paid for. The discussion is not limited to foremen, of course.

Discussion of Earlier Topics

Foreman Should Report Suggestions

IN MY Round Table discussion I may be presenting ideas that are somewhat reactionary, but I am thinking in terms of resultant efficiency in improved output and reduced cost, rather than of Utopian ideals that may end in dissension and chaos.

Should Al send Scotty to Williams in order to "put over" an idea for the benefit of the company?

No. If Al is a real leader, Scotty's ideas are largely the result of Al's development of Scotty's initiative and workmanship and need only be presented to the "super" if it is necessary to get permission to change standard practice. In such a case Al should be the one who best knows the whole story. There is as yet no credit to be given to any one. In case the idea is one of the few that do not "die aborning" and really results in a gain for the company, then the fact that there is "glory enough for all" will make Al give credit to Scotty frankly, and a word of praise from Williams, or better still, a remembrance in Scotty's pay envelope will help everybody the next time.

Is Al's job in danger?

Yes, all of our jobs are always in danger unless the concern "has gone to seed," which is the greatest danger. If Al has a man under him capable of taking his job away from him, the sooner he can "sell" him to the management for promotion to some better job, the better for all concerned.

Should Williams have foremen's meetings?

If he realizes that the foremen's meetings are often an opportunity for some lightweight to use the moral support of a foreman's meeting with a paucity of ideas to present some half-baked scheme, and is still confident of his ability to guide and control it in constructive channels, yes. Otherwise, and generally, no.

—ROBERT B. MCLOUGHLIN.

* * * * *

Some Pointers for the Superintendent

BY SENDING Scotty to Williams, Al was right, providing he arranged their meeting for discussing the Pulitzer job, thus maintaining his superiority toward Scotty and loyalty toward the company. The way Ed suggested would soon destroy the employee's pride, loyalty and inventiveness. Better co-operation and discipline would be created by establishing a suggestion system with paid rewards to successful suggestors.

The old superintendent was not right in his attitude toward workers. He should, of course, limit his contact with them to purely welfare and social problems, trying to discover any cause of discontent and at the same time to strengthen their good-will toward the company. Production, organization and suggestion phases of employee relationship, providing there is no committee representation or suggestion system, should be handled through the foreman. Contact between the workers and the superintendent should be prearranged by him.

Al will not lose his position, providing he is a result-getter and Williams is big enough to give credit where it belongs. Certainly, if Scotty keeps up his suggestive work, and studies and acquires other abilities needed for successful leadership, he will get a chance to demonstrate his abilities. Al, at worst, would be transferred to another department in the same capacity or probably promoted to a better position.

—JAMES V. WILD, *Foreman.*

* * * * *

A Letter to Al

DEAR AL:

Don't think I'm finding fault with the way you looked at that suggestion of Scotty's on the Pulitzer job. It doesn't pay, these days, to try to grab the credit for the other fellow's ideas.

But don't ever forget that you are the foreman of your department. Why didn't you *take* Scotty to the big chief instead of sending him? It was his idea, but that's no reason why you shouldn't have been in on the discussion when he took it up with Williams. Where was Scotty when you first ran a planer? And where was Williams, too, for that matter? Don't you think you could have helped a bit in getting the idea into its final shape?

When the job goes through the shop it'll be up to you to see that it works. You'll have to go over the whole thing anyway. Why wait? It's a lot easier to combine your ideas while the job is on paper than it is after it gets into the shop.

Another thing, when a youngster comes through with an idea like that, and you think it's good, why not help him to get as much credit for it as possible? When you sent him to the Super alone he was probably nervous. He couldn't put over his idea as well as if he had had you there to back him up.

This Scotty is a clever boy and I shouldn't be surprised to see them take him for the drafting room or the planning office one of these days, but I shouldn't worry about my job if I were you. It takes too long to make a foreman who can get along with his men the way you do, and who can get out the stuff regardless of what happens, for them ever to let you go.

—B. A. WALTERS.

THE · NEXT · TOPIC

Letting a Man Try His Own Way

QUESTIONS

Should the foreman insist on every job being done his way?

If he does, what is going to be the effect on the men?

If he does not, will the men lose respect for his ability?

Which is better, good discipline or new ways of doing jobs?

The topic discussed was presented on page 24, Vol. 65.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Protecting Steel Against Acid

By O. Holm

In our engraving plant, the steel shaft that drives the paddle in the etching tank was eaten in two by the action of the etching fluid (20 per cent nitric acid). The shaft was originally protected by a covering of hard rubber, except at the journals. The rubber covering had broken off, allowing the acid to get in its work.

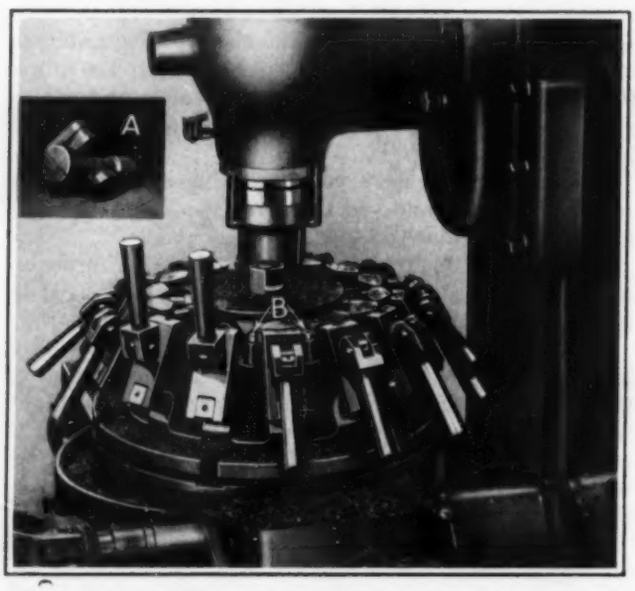
We were up against it, since it would have taken a week or more to get a new shaft from the factory. Not having any knowledge about the working of rubber, we decided to make a new shaft and cover it with aluminum, having plenty of scrap around the plant.

The new shaft was rough turned, then heated and placed in a mold, and melted aluminum poured around it. It was then finish-machined and the paddle was fastened in place by pouring melted rosin in the hub. The shaft was made about a year ago and has been in continuous service ever since.

Fixture for Holding Odd-Shaped Forgings

By J. E. Weber

For milling some odd-shaped brass forgings, one of which is shown at *A*, the holding was somewhat of a problem. Since the quantity to be milled was very large, we felt warranted in building a fixture that would give us practically continuous production.



Rotary fixture for milling brass forgings

After considering various schemes, the fixture illustrated was decided upon. It holds fourteen pieces, locating them from the flat surfaces underneath the ears, on two hardened pins as at *B* in the outer ring. In addition, the round shanks were located in V-notches in the hardened center block, over which is a hardened plate having an angular face.

The swinging clamps have Vs that hook over the large ends of the forgings, pulling them down on the locating pins and into the V-notches, forcing the ends against the angular plate. Thus they are firmly held at both ends. The clamps are tightened by eccentric levers.

The fixture is used on a Kearney & Trecker milling machine equipped with a high-speed vertical attachment and a rotary table. The production is 300 per hr. and could be increased were it not for the inability of the operator to load and unload at greater speed.

Making a Difficult Operation Easy

By George Feltner

Sometimes it is better to construct a part of two pieces and assemble them, rather than to attempt its manufacture in one piece, especially if the machining operations are of a difficult nature. Such a condition was encountered in the making of aluminum rotor caps for Maytag washing machines in each of which there is

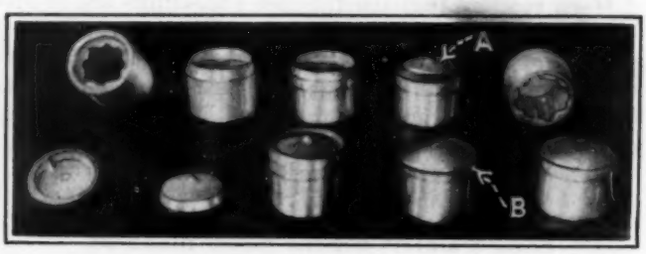


Fig. 1

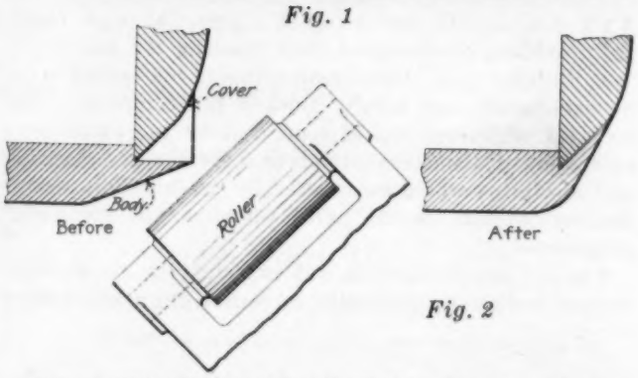


Fig. 2

Figs. 1 and 2—Procedure in making aluminum caps

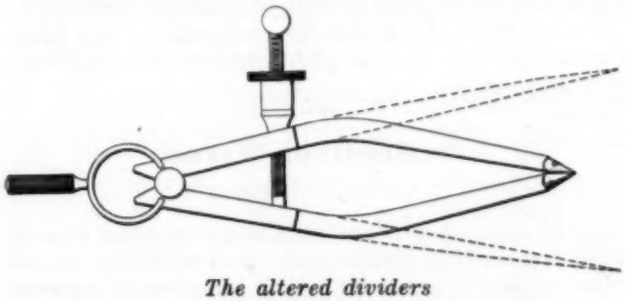
a 1¼-in. square hole, 1½ in. deep. It is necessary to have the square opening finished accurately to fit the rotor. In making the caps in one piece, the bottoming of the hole caused trouble, since there was no relief for the cutting tool.

The caps are now made in two pieces as illustrated. At the left, in Fig. 1, are shown the body and the cover as cast. The body is broached inside to size and then located on an expanding, square arbor in a turret lathe where the angular edge and the counterbore are machined. Likewise, the cover is provided with an angular edge and is turned to fit the body. The roller, used for closing the parts, is presented to the work in an angular position so that it will strike the projecting edge of the body. As pressure is applied the edge of the body is rolled over the cover, producing the piece as shown at *A*. The work then is turned on the head end, the finished piece being shown at *B*. After the head has been polished the joint is practically invisible. Fig. 2 shows the method of assembly.

Improving Toolmakers' Dividers

By Philip F. Shafran

The commercial machinists' or toolmakers' dividers are not as rigid as they should be. The legs are generally too long, too thin, and the points do not come close enough together to permit the scribing the small circles required on some work. In addition, the needle-like points will seldom stay in the prick-punch



The altered dividers

mark; also the frailty of the legs often causes the points to be deflected when attempting to scribe a deep mark.

To overcome these faults, I altered a pair of dividers as shown by the accompanying sketch. First, the legs were shortened to give them the necessary stiffness. They were then heated and bent as shown, so the points would touch when the legs were brought together. The inner sides of the legs were filed flat and parallel to each other when they were ¼ in. apart, making a slight angle when brought together. With the points close together, they were ground to an angle slightly less than 60 deg., then hardened and tempered. The results obtained repaid for the time required to make the change. The points being of nearly the same angle as the prick punch, kept the one in the punch mark well centered. The stiffness of the legs enabled me to scribe a clean cut circle, and the shape of the points allowed a deep impression to be made. The points have a cutting, rather than the scratching action usual in needle-point dividers.

Magazine Attachment for Second Operation Work

By Henry Simon

Fifty-thousand steel parts, like the one shown at *A*, had to be cross-drilled in a second operation. Since we had no magazine attachment for our automatic, we designed and built the device shown in the illustration. The entire cost for labor and material was only a few dollars.

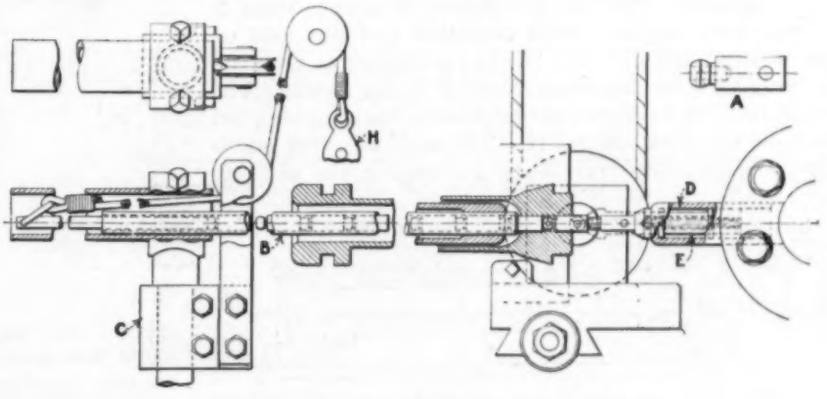
A magazine-tube was held in the feeding finger of the machine, the longitudinal movement of the feed tube being killed, and the parts advanced through the action of a pusher rod actuated by a weight.

Two magazines as at *B*, about 7 ft. long, of seamless, drawn brass tubing, were provided so that one could be loaded while the other was in use. The cord by which the pusher was pulled forward, was run over two pulleys, the lower one of which was rigidly mounted directly in front of the stock tube, between two steel straps attached to the wooden clamp *C*, which gripped the tube stand. The magazine tube, pusher and cord were all contained within the stock tube. A 50-lb. weight was used to operate the mechanism.

The parts were fed out against the spring-stop *D*, held in the turret. Stop *D* was made with a shell body in which a spring-actuated plunger *E* had a movement slightly greater than the length of the part. A standard drilling attachment was used on one of the cross slides.

In operation, the chuck opened, allowing the part just completed to slide out against the spring plunger, and compressing the latter to its limit. Upon the chuck closing, the drill advanced to its work, while the turret dropped back by an amount a little in excess of the travel of the plunger in the stop, thus allowing the first completed part to fall out.

To make the raising of the weight convenient, a small auxiliary pulley *H* and a rope were used between the weight and the end of the pusher cord. The length of the cord was so proportioned as to let the weight touch the floor when the magazine was exhausted. By unfastening the auxiliary rope, the pusher could be instantly pulled out ready to insert it into the new magazine. The weight was then raised into position and fastened, when all was ready for the work to begin again. About one minute was required to change magazines and re-start work. The operator had plenty of time to reload the spare magazine while the machine was at work on the pieces in the other one.

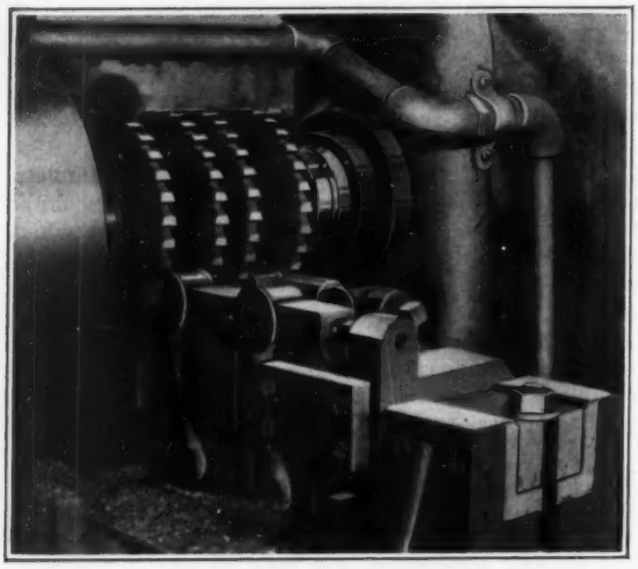


Details of the magazine attachment

Fixture for Milling Connecting Rods

By Frank Waldo

Instead of making an indexing fixture for straddle milling the ends of connecting rods, the fixture shown was designed for use in a small motor plant where a variety of rods are manufactured. The fixture-base, mounted on the machine table and used for fixtures for



Straddle milling connecting rod

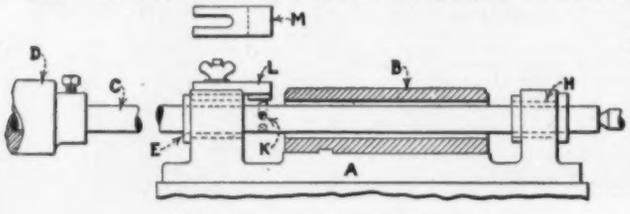
all sizes of rods, has locating pockets at each end, provided with hardened steel plates into which the ends of the fixture proper are placed. Hinged bolts hold the fixture to the base.

Two fixtures for each size of rods are provided so the operator can load one while the other is in use. The fixture is reversible and can be placed in the base either side up so that both ends of the rods can be milled. The fixture holds four rods, two on each side, as shown. The cutter speed is 60 r.p.m. and the feed is 4 in. per minute.

Gage for Setting Boring-Bar Cutters

By John K. Trask

A lathe fixture like that shown at *A* was used for boring a long hole in the cast-iron piece *B*. The fixture was mounted on a special block on the lathe carriage, and a single bar *C* was used for both roughing and finishing cuts. The bar was driven by a nose piece *D* on the lathe spindle, while the other end was held on the tailstock center. The bar had a bearing at each end in the adjustable bushings *E* and *H* in the fixture. The roughing tool at *K* was removed after the roughing cut and the finishing tool put in. The work was very exacting, and difficulty was found in keeping the work to



How the gages were used

size. The trouble was overcome by using tool setting gages at *L* and adjusting each tool (as it became worn) until it made contact with its proper gage. The gages were in the form shown at *M* and were fitted to slide in a hardened block on top of bearing boss. The tools were tested for each piece, and the adjusting screw in the bar was set up whenever required. After this was done, very little trouble was experienced in keeping the hole to the required limits.

Straightening Cold-Rolled Plates—Discussion

By F. W. Bach

In an article under the title given above, on page 870, Vol. 64, of the *American Machinist*, H. R. Fowler gives his experience in trying to straighten some cold-rolled plates. At the end he requests anyone familiar with the work to tell him the proper way to do the job.

Some years ago, I had to flatten a number of saw-steel disks having a hard, glazed scale on the surfaces. Ths disks had to be faced in a lathe to within 2 in. of the outer edges, so as to remove the scale from that part.

We tried flattening them by laying them on an anvil and striking them with a hard hammer, using both the flat end and the ball peen. The hammering upset the metal and left it full of dents, and after the facing cut had been made, the disks would spring back to their original condition when unclamped from the faceplate.

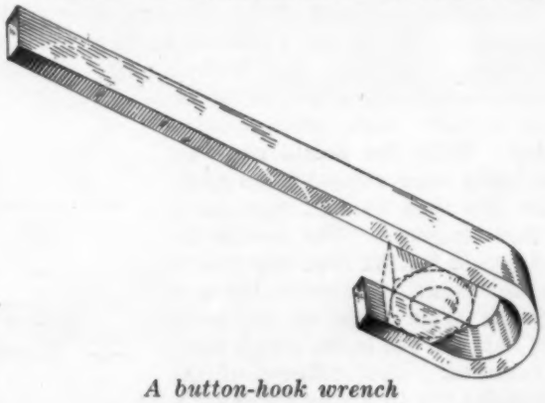
At last we tried striking the disks with a lead hammer, laying them on a flat plate and were able to flatten them successfully.

A Button-Hook Wrench

By Clifford H. French

It's no easy job to forge out a large open-end wrench in the ordinary blacksmith shop. And while the wrench shown is not recommended for all occasions, it answers very well for handling the nut on the end of a large, double-cone mandrel used to turn connections for a gas engine.

The wrench was made by simply bending one end of a square bar into a hook with the proper opening for the nut, about 4 in. across the flats. It is easily handled



A button-hook wrench

after a man gets accustomed to pulling it on the nut like a button-hook instead of pushing it on, as with the regular open-end wrench. For emergencies or for occasional use such as this, it works very well.

Metal Working Industries Activity

June Operations Above Average

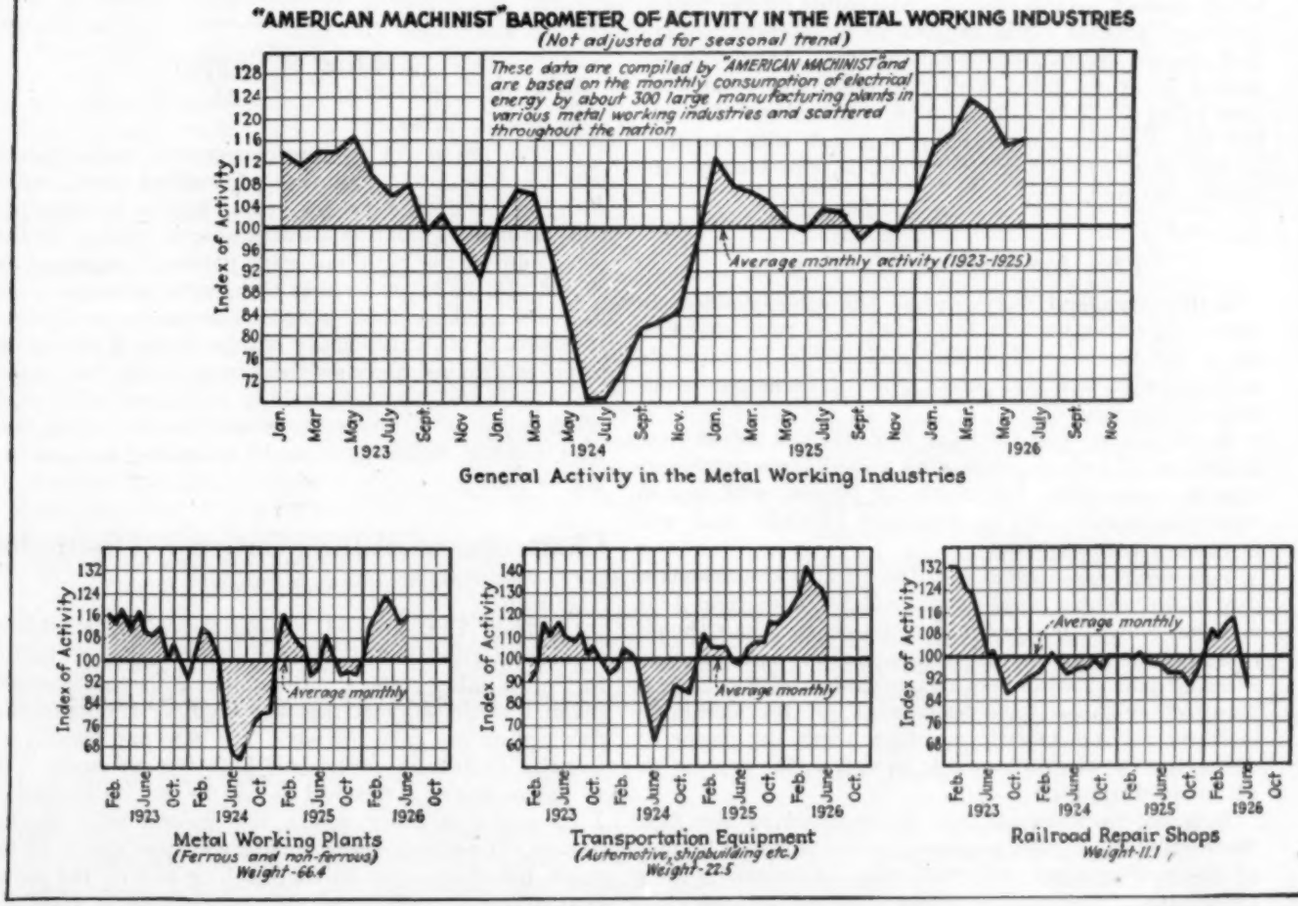
The first six months of the present year has witnessed activity in the metal working industries of the nation on a higher level than that reported during the boom year 1923. The year opened with the industry as a whole operating at 14.8 per cent above the monthly average for the past three years, which in turn is 3.3 per cent above the activity expected during January after seasonal corrections are made. This monthly rate of activity increased until in March the reports indicated an activity of 23.3 per cent above the average.

Activity decreased during May, but June witnessed a small increase in operations. June activity in the metal working industries was 19 per cent higher than in June of last year, at which time the activity was 2.5 per cent below the monthly average. There is every reason to believe that the present year will be a record one for the metal working industries.

The actual production activity of the metal working industries during the month of June was about 1 per cent above that of May, the same companies reporting an electrical energy consumption during June of 65,830,000 kw.-hr. as compared with 64,400,000 kw.-hr. in May. Normally the June consumption of electrical energy is about 9 per cent under that of May. These June reports of activity indicate operations in the metal working industries slightly greater than those experienced by American industry taken as a whole.

The opening of the year found the metal fabricating plants of the nation operating at 13.2 per cent above the monthly average for the past three years. A higher rate of operations, however, is normal in January, and a seasonal correction indicates that activity during January was really slightly below normal for that month. Increased operations were reported in February and March, followed by a small decrease in April and May, but June records show a noticeable increase in activity. The production activity during June is normally close to the lowest of the year, and January usually reports the highest activity of the year, but the June just passed found the metal fabricating plants calling for 4 per cent more electrical power than in January.

Railroad shop activity appears to have decreased during June, these metal working plants operating at 11.0 per cent below the monthly average for the past three years. This low activity is, however, seasonal in character. Activity in the automobile plants has been on the increase since May of last year, the high point of operations having been reached in March.


"AMERICAN MACHINIST" BAROMETER OF ACTIVITY IN THE METAL WORKING INDUSTRIES
(Not adjusted for seasonal trend)
These data are compiled by "AMERICAN MACHINIST" and are based on the monthly consumption of electrical energy by about 300 large manufacturing plants in various metal working industries and scattered throughout the nation
Index of Activity
Average monthly activity (1923-1925)
1923
1924
1925
1926
General Activity in the Metal Working Industries
Metal Working Plants
(Ferrous and non-ferrous)
Weight-66.4
Transportation Equipment
(Automotive, shipbuilding etc.)
Weight-22.5
Railroad Repair Shops
Weight-11.1
Average monthly

© American Machinist

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Tinning Iron Castings

Q. Can you furnish any information on the tinning of gray iron castings?

A. The process commonly followed in tinning iron and steel consists in hot dipping the articles in a tin or lead-tin bath. The parts to be dipped must first be cleaned thoroughly in an acid bath. A palm oil dip is also used between the cleaning process and the tin dip to protect the metal from any corrosive influences and to act as a flux.

If you desire to tin the castings for the prevention of corrosion, may we suggest that you investigate other processes which we feel would give better results? Tin is a metal that is termed "cathodic" to iron, and when used as a coating will accelerate corrosion at places where the base is exposed. Any pin holes or breaks in the coating are, therefore, serious defects from the standpoint of corrosion protection, and you are likely to experience difficulty in coating iron castings with tin because of the liability of an irregular coating.

Zinc is considered a good protection for iron against corrosion. The parts can be hot-dipped in the zinc after being cleaned, or the zinc can be applied by the "sherardizing" process. The articles to be sherardized are first cleaned and pickled, or sandblasted. They are then packed in drums filled with zinc dust, and rotated at slow speed for 3 or 4 hours at a temperature of about 700 deg. F. The zinc actually combines with the iron instead of merely covering the article, and a close protective coating is formed.

Flux for Melting Aluminum

Q. We have had more or less the same problem in melting old aluminum as the inquirer on page 994, Vol. 64, of the American Machinist, *and wonder if you could recommend a flux that would prevent excessive oxidation during melting.*

A. We do not feel that any flux will get rid of your difficulties if you are employing miscellaneous old castings for remelting, but much, of course, will depend upon the quality of the secondary castings that will meet your requirements.

You might try a small quantity of zinc chloride as a flux. The amount used should not be more than ¼ of one per cent of the weight of the charge, and should be added after the melt is liquid and ready to be poured. Stirring and skimming is recommended with this flux. Many other fluxes have been tried out for aluminum melting, a characteristic required being the power of dissolving the aluminum oxide as well as the prevention of oxide formation.

But too much should not be expected of the flux. Most emphasis is always placed on the previous history of the melting stock, and this must be selected with a knowledge of its chemical composition, or uniform castings of good quality cannot be expected. We believe that you will get results from a flux, but it is probable that more direct benefit will be derived from careful selection of scrap, and from correct melting and pouring.

Wear of Silent Pinions

Q. We are using a rawhide pinion between two gears, but find that while it answers our purpose as a noise reducer, we do not get satisfactory service. The pinions do not stand up in service, becoming soft rapidly. Can you suggest another material for this purpose?

A. Rawhide pinions are satisfactory noise eliminators, but will not stand up in service if subjected to flooding with mineral oils. You will probably find that the softening of the pinions is due to the lubricant employed. If a hard grease and graphite mixture cannot be used, you should change to the use of one of the silent pinions made under various trademarks. These materials are claimed to be impervious to water and oil, and should give you the lasting qualities desired, although in some cases pinions made from them may not be as silent as the rawhide pinions.

Welding of Copper

Q. Is it possible to do good welding of copper by the oxyacetylene process?

A. The process of welding copper with the oxyacetylene torch is similar to that of welding steel, except that the metal does not require as high a temperature, and the flame should be diffused over a greater surface on account of the rapid radiating power of copper. Care should also be taken to heat both parts evenly in order to avoid cracking from unequal contraction on cooling. It is easy to burn the copper in a hot flame if the melted metal is dropped through the air, and for that reason the welding rod is usually held in contact with the work. Welded copper is similar in properties to copper castings, and the welded part can be toughened by hammering or rolling.

Chattering of Milling Cutters—Discussion

By I. B. Rich

On page 726, Vol. 64, of the *American Machinist*, there was published a problem regarding the chattering of milling cutters. In addition to the remedies given I would suggest that the inquirer try running a flywheel on his cutter arbor. The size and weight are usually limited by conditions, but it is generally safe to use as heavy a flywheel as can be put on the arbor. I have known cases where this helped to a marked degree. It not only tends to reduce chatter marks on the work, but it is easier on the machine and on the motor that drives it. On a belt-driven machine it gives the belt a more evenly distributed load.

Technical Abstracts

X-Ray Tests of Welds

Experiments to determine the reliability of X-ray tests of welds have been conducted by the Union Carbide and Carbon Research Laboratories and the Watertown Arsenal. The welder set out to produce good, fair, poor and bad welds in boiler plates. Coupons cut from the four zones, when broken in a tension testing machine, proved that he knew what kind of a weld he was making. The X-ray tests showed such defects as gas pockets, oxide infusions, and cracks nearly parallel with the rays but were not reliable where the fusion had been poor. P. W. Swain in *Journal of the American Welding Society*, June, 1926, page 50.

Die Grinding Calls for Accuracy

To grind segments of hardened steel so that they will fit together accurately to make a complete disk, or ring, is a difficult operation; especially when many segments are involved. Such a problem is encountered in the construction of dies for stamping electric motor laminations. An error of but 0.0002-in. multiplied by 48 segments, gives a total error of 0.0096-in.; which is sufficient to prevent the parts from fitting together. The job requires not only accurate grinding but close mathematical attention as well; for the angles must be carefully computed and set up on the grinding form.

A set of tools of this kind has recently been completed by the C. O. Deveau Machine Tool Co., of Charlestown, Mass., for one of the larger electrical manufacturing companies. The segments were made of a special die-steel. The stock was first planed to width and then the sides planed to an angle of 7 deg. Milling, drilling and tapping operations complete the work upon the material in the soft state, and the parts are then hardened.

Grinding proceeds very cautiously from the start. The roughing operations are such as might be considered finish ones on less accurate work. The pieces are ground all over; the scheme being to rough-grind to within 0.001 in. of finish size, using feeds of not more than 0.001 in. A manufactured alumined wheel of 46 grit, 7 in. in diameter by ½ in. face, was used; running at a peripheral speed of 4,500 ft. per minute.

An extremely light finishing grind is necessary because the heat generated by the wheel in finishing one surface would be sufficient to throw an already finished adjacent surface out of true. Herbert R. Simonds in *Abrasive Industries*, July, p. 210.

Heat-Sensitive Paints

Paints that change color as the temperature rises and resume their original color when returned to normal temperature are useful for detecting temperature rises in certain bearings, the level of water in hot water tanks, etc. The double iodide of copper and mercury changes from bright red to brown at 70 to 80 deg. C. and black at 100 deg. C. The double iodide of silver and mercury changes from yellow to dark orange or brick red at 70 to 80 deg. C. Either can be obtained by procuring the separate iodides from chemical supply houses and mixing them mechanically. Either mixture should be finely ground and mixed with a thin, light-colored non-acid oil or with spirit varnish and applied with a brush. They are useful on tinned iron or brass but not on aluminum. If the powdered iodides are not procurable they can be made from substances obtainable at any good drug store. W. S. Andrews in *General Electric Review*, July, 1926, p. 521.

Non-Technical Machine Design

The tendency of young engineers is to overestimate the technical side of design and to overlook often the role of common sense in the engineering of a machine. Many impossible and absurd designs sometimes result. For example, a closed vessel is intended to be riveted but is so fabricated that the last set of rivets cannot be placed. In developing a mechanism the keynote should be simplicity, as an ingenious but complicated mechanism may be so costly as to be unsalable. It is also most important to provide for easy replacement of parts that are subject to wear. In one case it was estimated that it would cost $20 to replace a four cent felt washer for the rear bearing of an automobile engine because the engine would have to be entirely dismantled. A clearance for semi-moving parts should be kept in mind to avoid ultimate interference. Likewise, the method of manufacture should influence the design to a large extent. All drawings should be absolutely clear, or, as happened in one case, the designer may get half a forging, because the drawing showed a half section. If common sense and theoretical computations conflict, accept the former. An hour's thought at the drafting board may save ten in the shop. Max M. Frocht in *Mechanical Engineering*, July, 1926, p. 738.

Selecting Apprentices

The objects to be attained by apprenticeship training are three: first, to create in the young journeyman a spirit of craftsmanship consistent with the present status of industry; second, to develop good all-around workmen; and third, to help human beings to live more fully. In broad terms these ends may be attained by introducing training courses that will combine manipulative skill with a general craft knowledge.

To insure the requisite of successful apprenticeship considerable effort often needs to be expended in recruiting good material and great care should be used in selecting the prospective apprentice. Owing to various reasons set forth previously, the number of young men wishing to enter upon a long course of training is not large. In the past it has been customary to draw largely from the friends and relatives of apprentices or workmen already in the shops, but this has not presented a broad enough field for selection. Definite recruiting methods, therefore, must be resorted to in order to insure a sufficient number of suitable applicants. Dorothy Sells in *Industrial Management*, June, 1926, p. 351.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Foreign Trade Advances

AFTER all the inflation has been squeezed out of the figures, dollar values of the international trade of the world are about on a par with the figures of pre-war days.

According to Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce, the figures for 1925 were $57,608,000,000, which, in terms of the present inflated currency, is about equivalent to the $38,710,000,000 of 1913. The 1925 figures represent an increase of some 13 per cent over 1924.

Of considerable interest to American manufacturers, and to manufacturers abroad as well, are Dr. Klein's figures on the rapid increases in the foreign trading of such countries as Colombia, Argentine, Japan, New Zealand, British Malaya and Egypt. They have made up for the sag of European markets and are well worth cultivating.

What Is a Fair Price?

THE question of basing prices on cost or service may have numerous answers. There is one point, however, that is very frequently overlooked. And that is as to what the "cost" really is. In too many cases one of the most important items of cost is overlooked—the engineering expense.

We are apt to count only the physical costs in considering a basis for setting prices. The cost of engineering and value of the years of experience that made the new devices possible, are often forgotten. And yet they should be counted in the cost.

If experience enables a designer to build machines that require practically no attention, is he not entitled to a higher price even though they cost no more to build than ones needing frequent repairs?

One for All and All for One

A FARMER went to work in a railroad shop. When he had to clean out the grease chambers on side rods, he naturally saw the similarity between digging grease out of a hole and digging up mud for a post hole. So he devised a tool that is nothing more than a post-hole digger. A few turns of the wrist sinks the tool into the grease and a pull upward brings the tool out of the chamber with all of the grease ahead of it.

Another farmer, working with a railway mechanic, helped him out of a trying situation. The mechanic had bored a pulley, carefully measuring both shaft and hole. When finished, the pulley would not go on the shaft. "Turn it end for end," said the farmer. The mechanic did so and the pulley fitted. The spring of the boring tool had made one end of the bore slightly small.

It isn't natural for a mechanic to look to a farmer or to a laborer, or even an apprentice for valuable suggestions in shop work. The two examples given, however, indicate that ideas may come from the vast unexpected sources. They show one of the advantages of giving rewards for suggestions. Open minds and liberal policies are conducive to getting the most out of the personnel. It is not always most advantageous to rely entirely upon the tool designers, methods department, or efficiency engineers, just because they are paid for thinking up short cuts.

Have the short-cut men by all means—as a rule they more than earn their keep. But make it possible for even the laborer to put across a good idea. The fact that they know they have the opportunity to see results from their ideas will make the men in the shop much more likely to think.

Protecting Worthy Air Craft Development

ARMY aviation has been struggling against severe odds, legislative and otherwise, ever since the close of the war. With the passage of the new aviation measure a more hopeful period begins, particularly for the builders of patented products.

In the past, progressive manufacturers who have spent thousands of dollars in developing new designs have received little encouragement. Designs and patents have been ignored and orders placed with the lowest bidder, even on patented articles. The concerns that had no development cost, but merely copied the work of others, could naturally build at a lower price. And they have been encouraged to do so. The ethics of business have apparently never been heard of by some of those in charge of the letting of contracts.

The new bill provides for recompense to the designer or patentee in case he is not the lowest bidder, which is as it should be. Unless this is done the army will find itself purchasing material of less modern design than is being supplied to air forces of other countries.

We all want the air service to secure the best material available and at a fair price. Nor should the source of supply be too limited. But unless those who develop new and worthy devices can be protected against having the benefit of their labors reaped by others, it will effectually limit such development. The new bill should correct some of the mistakes made in the past along this line.

Shop Equipment News

Bullard "New Era" Vertical Turret Lathe, 54-In., Improved

An improved vertical turret lathe of 54-in. capacity, with one swivel turret head and one non-swiveling side-turret head, is being offered by The Bullard Machine Tool Co., Bridgeport, Conn. The machine shown in the accompanying illustration has a table diameter of 50 in., but will actually swing work 56 in. in diameter. The height under the cross-rail is 35½ in., and the maximum distance from table to turret face is 49 inches.

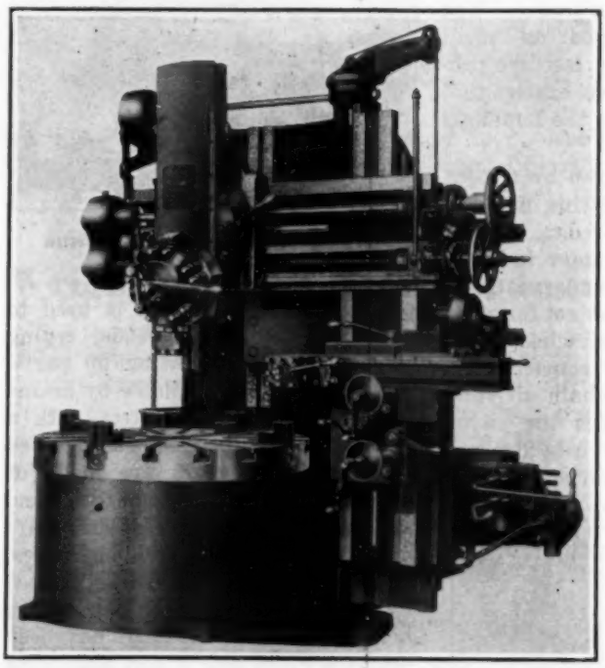


Fig. 1—Bullard "New Era" Vertical Turret Lathe, 54 In., Improved

The table and table-spindle are of the standard Bullard type, with planed bevel-gear table drive. The spindle thrust bearings are ground concentrically on a machine built especially for this purpose.

The bed casting of the machine has been strengthened, and machined pads are now provided on the bed for the support of a forming attachment bracket for the side head. The forming attachment is either of the plate type for such work as the crowning of pulleys, or of the universal type that may be set to cover a wide range of angles for machining bevel gears.

Other features that have been added to the machine include a cast-steel main slide, an all-steel turret, and a steel side-head slide. In Fig. 2 are shown details of the all-steel turret. At the same time it is announced that these features will also be incorporated in the complete line of Bullard vertical turret lathes.

The improved turret locking feature is made up of two steel rings screwed and doweled to the inner side of the turret and the face of the main slide, and it provides five pairs of opposed bevel surfaces that mesh positively at the five points of turret registry. These rings, illustrated in Figs. 3 and 4, are claimed to afford greater strength and accuracy, at the same time giving longer life. The all-steel construction of the turret and slide is intended also to increase the capacity of the machine for heavy cutting.

The side head has a vertical movement of 29 in. and a horizontal movement of 21 in. The head does not swivel. Quick hand movement in all directions is provided as well as means for making fine adjustments independent of the feed works. A 4-faced turret tool-holder is carried on the side head.

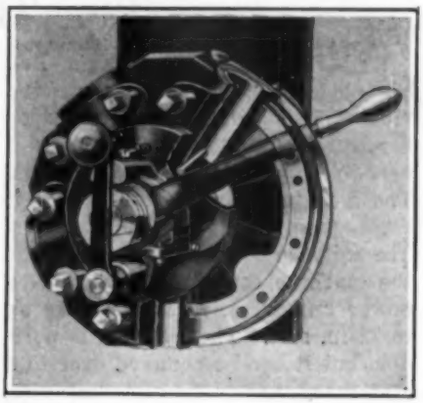


Fig. 2—The all-steel turret

Special attention has been given to the lubrication of all working parts, and an added feature of the machine is the adoption of pressure oil-gun lubrication for all bearings in the external units that are not reached by oil from the constant

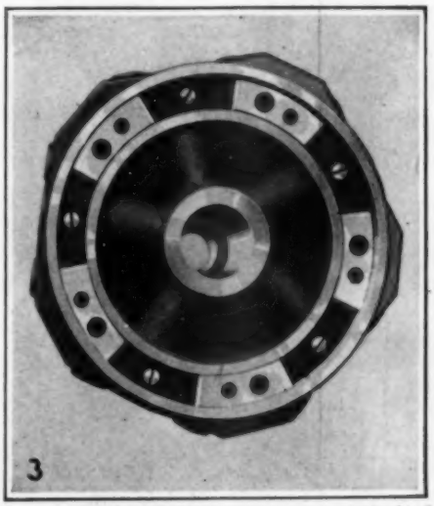


Fig. 3—Locking ring in the turret.

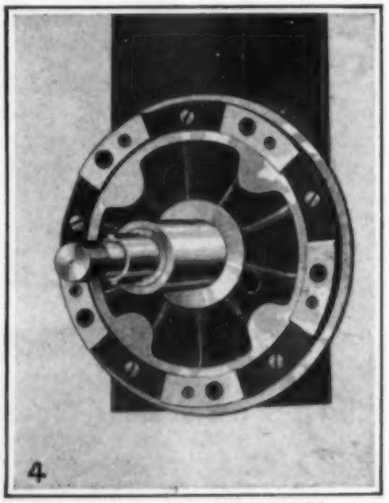


Fig. 4—Locking ring in the slide

Shop Equipment News

flow system or other unit reservoirs. An Alemite Zerk pressure oil gun is furnished as standard equipment with the machine.

The machine is intended either for countershaft or motor drive. When specified, the motor is fitted on a bracket at the rear of the machine and connected by belt with the driving pulley. The net weight of the machine is 23,000 lb. No special foundation is required for the machine, which takes up a floor space 117 in. wide by 120 in. deep. The total height of the machine, with rail and slide in the highest position, is 129 inches. The driving pulley is 24 in. in diam. and takes a 5-in. belt.

Hall-Will "Red-E-Hall" Portable Pipe Threader

Hall-Will Incorporated, Erie, Pa., has placed on the market the "Red-E-Hall" portable pipe threader illustrated for use in threading ¼ to 2-in. pipe and ¼ to 1½-in. bolts. The machine threads right and left hand pipe, cuts off, and reams. Through the use of a universal shaft the machine can also be used as a power unit to drive hand stocks up to 12-in. size. The machine is portable but it can be changed over to a stationary unit in a few minutes. Fig. 1 shows the front view, while Fig. 2 is an end view showing the driving motor.

All castings are made of malleable iron and other parts are made of steel. The machine is said to be strong and rigid. The elevating truck mechanism for portable operation is built into the machine. The rear feet are mounted on small wheels while the front feet are provided with double swivel casters that elevate the front when the handle is pulled forward.

The machine is driven by a 1-hp. reversible motor operating at 1,750 r.p.m. on either a.c. or d.c., through a silent chain. The motor is bolted directly to the frame underneath the bed. A turn-button control for start, stop, and reverse is attached to the outside of the frame convenient to the operator. The chain drive is fully inclosed. Besides the switch control a friction clutch is also provided for stopping and starting. It is operated by means of a lever on top of the machine and is used to facilitate checking threads, trying on fittings, and screwing up parts. Three speeds are available by means of a selective slide system with a neutral position between each geared position. The gears are made of heat-treated nickel-chrome steel and are run in an oil bath. All shafts are mounted on Timken roller bearings.

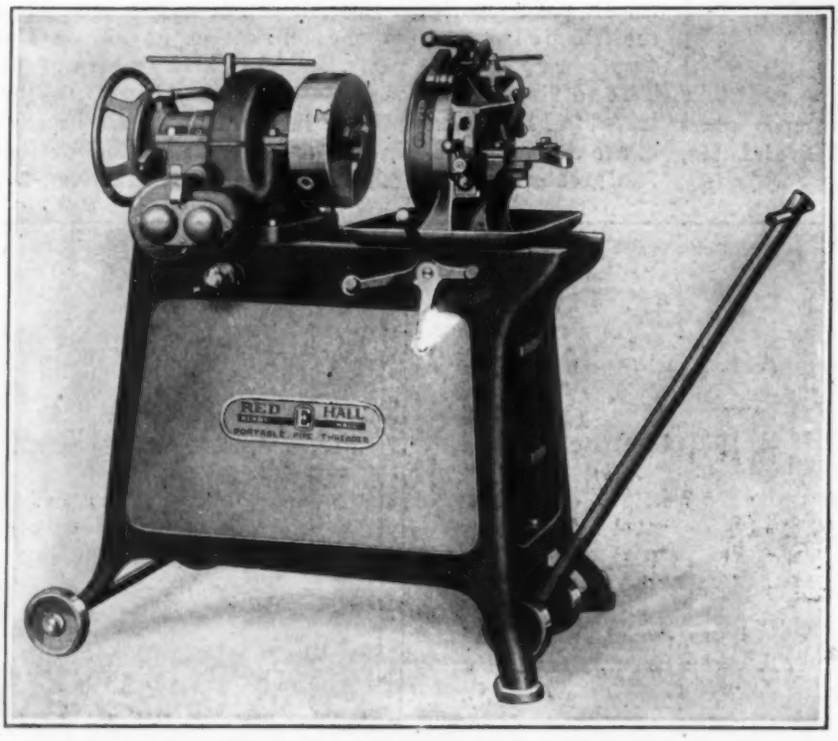


Fig. 1—Hall-Will "Red-E-Hall" Portable Pipe Threader

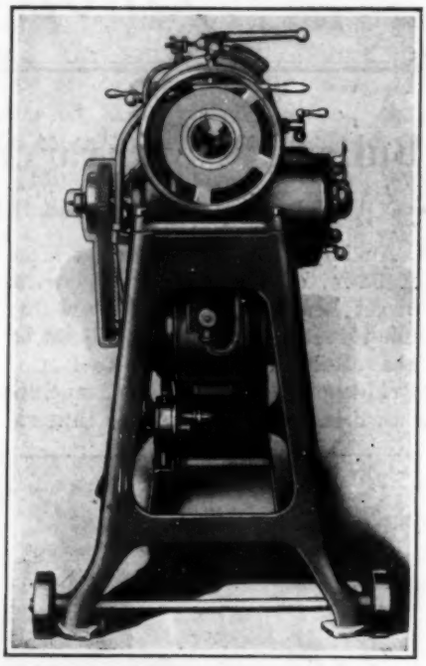


Fig. 2—End view of machine showing motor drive

The die-head is opened and closed by means of a lever on top of the head. Once the die-head has been set to a given size it can always be brought back to the same position by pulling the lever down to the locking position. Adjustment for over- and under-size threads is provided by turning two narrow nuts on the head bracket. Graduations are placed on the outside of the cam for setting the die-head for various sizes of pipe. It is said that the locking device on the head is simple and positive so that the head cannot open or shut while the thread is being cut. Cutting oil is forced into a chamber in the die-head and three outlets distribute it direct to the dies.

The highest speed is used for cut-off work. The cut-off block is mounted on a front V-block, the ways and support of which are cast solid with the die-head. The tool block is adjusted and steadied by means of a steel taper gib. The blade itself is made of tempered high-speed steel,

Shop Equipment News

beveled, and is set at an angle to give the best cutting results. The cut-off tool is fed into the pipe by means of a screw and handwheel.

Double opposed V-blocks having hardened tool-steel face plates steady the pipe during the cutting-off operation so as to prevent the pipe from chattering or climbing on the cut-off tool. The rear block which carries the load from the tool is extra wide. The V-blocks are actuated through phosphor-bronze nuts engaging right- and left-hand threads on a shaft rotated by means of a handwheel. A swivel-type reamer and chamfer lever carrying a high-speed steel bit is also mounted on the cut-off blocks.

In the front end of the bed is the chip pan and oil chute through which the cuttings are delivered to the chip box where the oil drains off through two strainers to a reservoir below. The chip pan is removable, and the oil reservoir can also be lifted out. It is of large capacity. The oil pump is reversible and is driven direct from the motor at constant speed. It is the rotary geared type and is situated on a level with the reservoir so that it is always primed.

Four sets of chasers are required to cover the complete range of the machine in the following series: ¼ and ⅜ in., ½ and ¾ in., 1 and 1¼ in., 1½ and 2 in.

The spindle speeds are 19, 34, and 69 r.p.m. The carriage travels 11 in. The shortest length of pipe the machine handles is 7 in., while the shortest length threaded is that of a close nipple. The hole in the spindle is 2⅛ in. in diam., and that in the head is 3 in. The machine occupies a floor space of 26x38 in., and its overall height is 43 in. It weights 450 lb. net., 530 lb. crated.

Wright-Hibbard Tier-Lift Industrial Truck

The tier-lift industrial truck illustrated is being manufactured by the Wright-Hibbard Industrial Electrical Truck Co., Inc., Phelps, N. Y., for use in narrow aisles and congested places.

Energy is supplied by means of storage batteries, either six cells of 21-plate Exide batteries, or twelve cells of A-8 Edison batteries. A feature of the machine is the fact that a single electric motor is used for both lifting the platform and propelling the truck. The change of drive from one function to the other is effected by means of a gear-shift lever.

The length of the truck is 87 in. with the operator's footboard down and 79 in. with the footboard up. With this short length it is possible to use this truck on most elevators. The regular platform is 42x18x6½ in., and the overall width of the unit is 27½ in. so that it can travel through narrow aisles. A platform 53x24x9 in. can also be supplied. The last dimension in each case is the height above the ground when the platform is in its lowest position. The drive wheels are 14 in. in diam. and 3½-in. face, while the two trailer wheels under the platform are 6 in. in diam. and 4-in. face. With the larger platform, the trailer wheels are 8½ in. in diameter.

Wright-Hibbard Tier-Lift Industrial Truck

This tier-lift truck is made in four heights of lift: 3, 4, 5, and 6 ft. The overall height of the unit is 18 in. more than the specified lift in each case. The rated capacity is 4,000 lb. The lifting speed is 7½ ft. per min. under full load and 17 ft. per min. without load.

This truck is interchangeable with the R-11 and R-12 elevating platform trucks made by this company. Either of these trucks can be converted into a tiering machine at small expense. Similarly the tier-lift can be converted into an elevating-platform truck if desired.

Frew Automatic Tapping Machine, No. 1

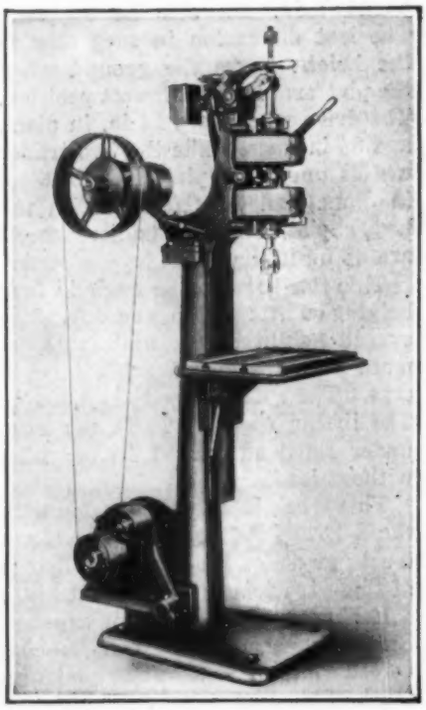
The Frew Machine Co., 124 West Venango St., Philadelphia, Pa., is marketing the No. 1 automatic tapping machine illustrated. The capacity of the machine is ½-in. U. S. Standard tap in cast-iron or steel, ¼-in. pipe tap in cast-iron and ⅛-in. pipe tap in steel. Motor drive is shown but the machine can also be driven from an overhead countershaft.

The machine consists of a base casting having dovetail slides cut out of the solid metal upon which a table moves vertically. The table is counterbalanced by a weight inside the column by means of a chain that passes over a sprocket wheel, which is turned to raise or lower the table. The table has two T-slots running its length and an oil groove around its edges.

The headstock mounted on top of the column carries all of the operating mechanism for tapping. The spindle is made of a special steel ground to size, and it carries a pos-

Shop Equipment News

itive drive chuck at its end. The spindle is carried in bronze bearings that support it for almost its entire length so that cocking is prevented. The two friction pulleys are carried on Timken roller bearings mounted



Frew Automatic Tapping Machine, No. 1

outside of the bronze spindle bearings, which are relieved from the radial load of the belts. The pulleys run in opposite directions for tapping and removing the tap from the work respectively. The motion of these pulleys is transmitted to the spindle by means of a cone-shaped friction member that is keyed to the spindle and that engages with the upper and lower pulleys.

A stop is provided on the end of the spindle to regulate the depth of tapping. The operator starts the tap in the work by pulling down the hand lever on the side of the machine. This motion causes the friction member to engage with the upper pulley and to lock itself in place. The rest of the cycle is automatic. The tap advances to the predetermined point, at which time the stop on the end of the spindle strikes a latch that releases the lock and engages the friction member with the lower pulley. The spindle reverses and the tap comes out of the work. All parts of the trip and release mechanism that are liable to wear are made of hardened tool steel. The mechanism is simple and is adjustable for wear.

For motor drive a hinged idler is attached to the machine so that the belt tension is maintained automatically. The motor is rated at 1 hp. at 1,200 r.p.m. The belt width is 2¼ in. while the friction pulleys are 8 in. in diam. by 3 in. face.

The table measures 11x18 in. The maximum distance under the chuck is 19½ in. The maximum depth of tap is 1⅝ in. The machine requires a floor space of 20x25 inches.

Multiple spindle heads can be attached, or two or three tapper heads can be mounted on a special base. A foot lever attachment can be furnished extra.

Newton Rail-Drilling Machine

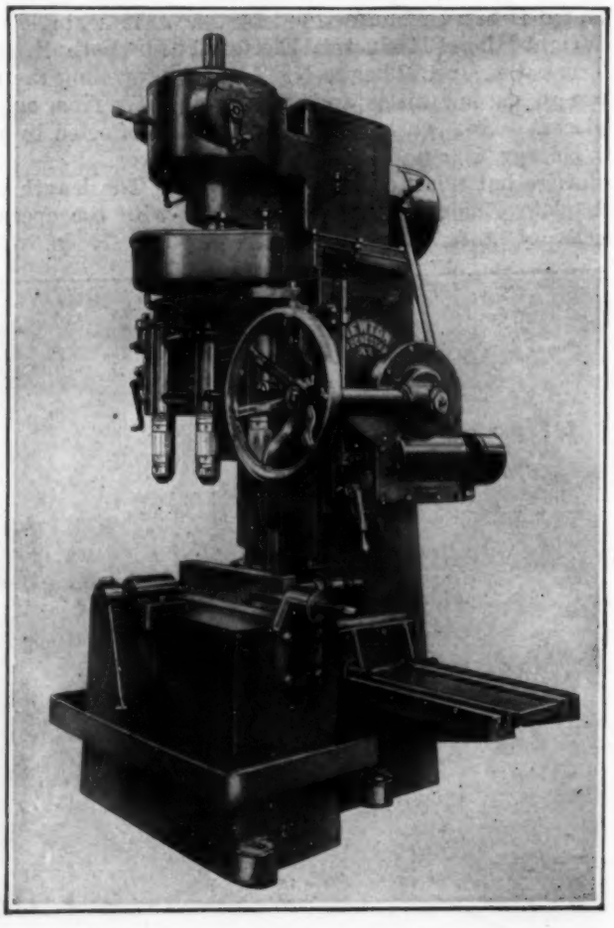
The Consolidated Machine Tool Corporation of America, Newton Works, Rochester, N. Y., is marketing the rail-drilling machine illustrated. The machine has been built especially for rail shops and is simple in design and operation.

The machine is fitted with three hardened steel spindles that are adjustable on a vertical saddle. The range of center distance between the two outside spindles is 12 to 24 in. The spindles are fitted with ball thrust washers and are driven by large-pitch, wide-faced gears. The spindle carriers slide in horizontal slots in the saddle and are adjustable for center distance by means of a screw, actuated by a hand lever. T-head bolts are used to clamp the spindle carriers in place. The saddle is counter balanced by counter weights within the upright that are connected to it by means of two chains.

The speed box and driving head are contained in a single unit. Speed changes are effected through triple sliding gears, shifted by means of a rack and pinion. The pinion is rotated by means of a lever located at the front of the head. The change gears have stub teeth and are made of heat-treated steel.

The feed is taken from the main driving shaft at the rear of the speed box and is transmitted through bevel gears and a vertical shaft to a worm and wheel unit at the rear of the right-hand side of the machine. The worm is provided with a slip friction clutch that acts as a safety device in case the drill sticks.

The final feed drive to the saddle is through a rack and pinion inside the column. The feed can be engaged or disengaged by a capstan handle. At the end of the operation the feed is knocked out by means of a rod



Newton Rail Drilling Machine

Shop Equipment News

with an adjustable collar that comes in contact with the feed trip on the saddle.

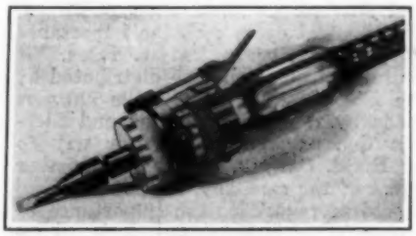
The work table is made integral with the column and is provided with T-slots for clamping the rail supports. A squaring block is provided that has an adjustment from the center of the spindle from 1¾ to 4 in. The clamping screw is at the front of the table and a stop screw is at the right-hand end.

The column is rigidly constructed and has a trough for retaining the cutting lubricant. A motor bracket is bolted to the side of the column and is provided with screws for adjusting the motor rails for tightening the driving belt.

"Flextol" Power-Driven Hand Tool, Types A and B

The "Flextol' power driven hand tool illustrated is being marketed by J. C. Edgecumbe & Co., 149 Broadway, New York, N. Y. The Type A tool is intended for screw driving and nut setting, while the Type B tool is for drilling, boring, grinding. buffing, and the like.

The power unit consists of a ¼- to ½-hp. motor operating at 1,400 r.p.m. suspended in either a vertical or horizontal position from a short



"Flextol" Power Driven Tool, Type A

track that is supported upon the ceiling or other convenient place. Coupled to the armature is a flexible shaft that transmits power to the hand tool. The flexible shaft is made of steel piano wire and is provided with a ball thrust bearing and revolves in a special flexible metallic casing lined with steel strips. Both the shaft and casing are light and flexible. The maximum length recommended for use is 10 feet.

In the type A tool the final drive takes place through a train of epicyclic friction cones, which have a reduction ratio of 5 to 1, thus giving a speed of 280 r.p.m. at the tool. The friction cones act as a clutch so that the tool does not rotate until pressure is applied that brings the sun cone into contact with the planetary system. The cone rollers and the outer ring are made of hardened steel and are accurately ground. The sun cone has an extended shaft that is slotted for a portion of its length and through driving pins is attached to the flexible shaft. The epicyclic gear, with its outer ring, fits into a holder made of aluminum alloy. The driver bits are made of a special alloy steel and can be readily attached to the tool. The type A tool weighs 2½ pounds.

The type B tool is fitted with a three-jaw chuck and is suitable for drilling holes in metal up to ¼ in. in diameter. The chuck runs at motor speed. The tool can also be fitted with a small emery wheel and mop. Two radial and one thrust ball bearing are provided. The tool has side handles, either or both of which can be detached or adjusted to the operator's convenience. The type B tool weighs 2¼ lb.

Both types of "Flextol" tools are interchangeable on the same shaft and can be readily changed in a short time. The tools are sufficiently light to be used with one hand and are small in diameter for working in corners and other inaccessible positions. They are capable of working at any angle.

Universal "Trouble Shooter"

The Universal Test Equipment Co., 2939 N. Oakley Ave., Chicago, Ill., is marketing the "Trouble Shooter" illustrated for use in locating grounds, open and short circuits, and other electric troubles.

The device consists of a pair of testing handles made of Thermoplex that is heat and shock proof, lead wires, and a special separable socket and plug. The handles have removable caps so that different sizes and lengths of lead wires can be inserted. Pointed steel prods are used to make contact. Two 5-ft. leads are furnished that are held together with four pure gum sleeves that can be adjusted to suit the range desired.

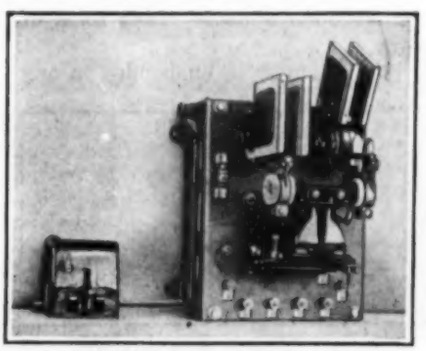
Universal "Trouble Shooter"

The plug fits any standard a.c. or d.c. lamp socket, while the socket is standard for holding any size test lamp. Ordinarily the test lamp is in series with the test handles so that the lamp lights when the circuit is completed, but a spring is furnished that makes it possible to place the lamp in parallel for use in testing live circuits.

Ohio "Push-the-Button" Magnet Controller

The Ohio Electric and Controller Co., Cleveland, Ohio, is marketing the push-button master switch and control panel illustrated for use with lifting magnets.

On the master switch two levers are exposed, one for lift, the other for drop. A barrier between the two prevents the accidental mixing of the levers. This master switch can be attached to the ceiling or side wall of the hoist cab or to the throttle of a locomotive crane to be operated by thumb or finger pressure, or it can be placed upon the floor and



Ohio "Push-the-Button" Magnet Controller

Shop Equipment News

operated by foot pressure. The master switch measures 5½x6⅝x6¼ inches.

The controller is designed so as to prevent arcing due to the breaking of a high voltage current caused by the inductive kick of the magnet. This kick-back voltage sometimes gets out on the line and causes trouble. The controller closes the magnet circuit for lift and opens the circuit for drop after applying a momentary reverse current to remove all residual magnetism from the core and to insure the load being dropped promptly, particularly if it consist of high-carbon steel. Permanently connected across the terminals of the switch is an iron-clad resistance consisting of five strips of Cromalox, which can be worked red hot, but which is just warm under ordinary conditions. The kick-back current dissipates itself as heat in this resistance and reduces the arc at the contacts to a minimum.

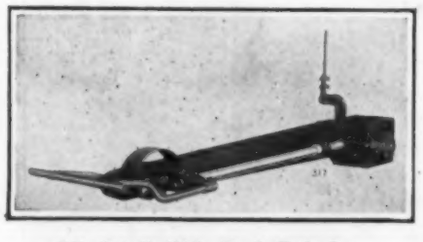
The switch is the double-pole type with a heavy steel cross bar and spring cushions to prevent injury to the insulators on each end of the cross bar. Blow-out coils and arc shields are provided at the contacts. All contacts have a wiping action and are self cleaning. Fuses are provided in case of grounding or a short circuit.

The control panel is 16 in. high, 14½ in. wide, and 14 in. deep. The resistance and internal wiring can readily be inspected.

"Safety" Side-Rod Grinder, Portable, No. 18

The No. 18 portable side-rod grinder illustrated is being marketed by the Safety Emery Wheel Co., Springfield, Ohio. It can be used for similar operations in other lines of work.

The unit may be suspended in any manner to accommodate local operating conditions. It handles with ease since it is counterbalanced. It may be speeded for any size and type of wheel up to and including 12 in. in diameter, whether the wheel be for grinding, polishing, or buffing. A special attachment for the mounting of small spools for grinding fillets is part of the equipment.



"Safety" Side-Rod Grinder, Portable, No. 18

Essentially the machine consists of a tubular support with an enclosed motor at one end and a spindle mounted on ball bearings at the other. A belt that is protected by a sheet metal guard connects the two and furnishes the drive. Suitable handles are provided at the spindle end to facilitate operation of the unit.

"Aloxite-Redmanol" Cut-Off Grinding Wheels

The Carborundum Co., Niagara Falls, N. Y., is using "Redmanol" combined with its regular "Aloxite" to form cut-off grinding wheels.

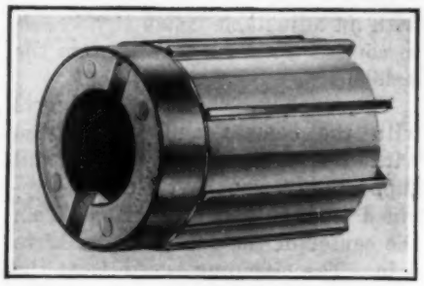
Redmanol is a synthetic resin and when used as a binder in wheel making it is said to possess strength, porosity, hardness and resistance to heat. It will not soften nor melt, and it has a porous structure that results in a clean-cutting wheel. It is claimed that this bonding agent combined with the abrasive Aloxite produces a cut-off wheel that goes through small stock of hardest steel at high speed.

The popular size cut-off wheel is 12 in. in diameter, although the wheels can be supplied 8 in. or under, 10, and 14 in. in diameter. The minimum thickness of the 8-in. wheel and smaller is $\frac{1}{16}$ in., while that of the 14-in. wheel is $\frac{1}{8}$ in. The recommended grades are as follows: for Stellite, 50 K grit, 4 bond; for miscellaneous work, 50 K grit, 6 bond; and for high speed and soft steel, 50 K grit, 8 bond.

Conradson Solid Reamers

The solid reamer illustrated is one of a line developed by the Conradson Tool Corporation, 2659 Clay St., Detroit, Michigan.

The tool consists of high-speed steel blades set in a die-cast metal body. It is claimed that this body has sufficient strength, ductility and hardness to withstand any strain that this reamer would ordinarily be put to under working conditions. A steel collar protects the neck against abuse. The tool is designed to fit any standard arbor. The simplicity of the method of die casting reduces the cost of the tool materially.



Conradson Solid Reamer

The reamers are made in 42 sizes ranging from 1$\frac{7}{16}$ to 3 in. in diam. The overall length varies from 2¾ to 4 in. The diam. of the hole at the large end ranges from ⅜ to 1½ in., while the arbor number varies from No. 6 to No. 10.

Pamphlets Received

Power-Factor Correction by the Consumer. Wagner Electric Corporation, St. Louis, Mo. Bulletin, No. 146. A twenty-two page, 8x10 ½-in. discussion of the experience of the American Gas and Electric Co., has been published. This booklet deals with the importance of power-factor in kw.-hr. rates. It contains a questionnaire distributed by the *Electrical World* and the answers made by the American Gas and Electric Co., as well as a letter written by H. M. Sawyer, general contracting agent of the company, to the *Electrical World* in regard to the importance of power-factor in industrial electrical installations.

Structural Steel for Locomotives, Standard Specifications. Industrial Standards No. 9. Issued by the U. S. Department of Commerce, Washington, D. C. The text is written in both Spanish and English and contains standard specifications for structural steel for locomotives as adopted by the American Society for Testing Materials. The booklet contains 16 pages.

Structural Steel Shapes. The Carnegie Steel Co., Pittsburgh, Pa., has issued a 195-page booklet containing information and engineering tables on structural steel. This booklet is a ready reference work for engineers and designers and contains much valuable condensed information.

News of the Week

Political and Industrial Disorganization Hampers Progress of Business in France

Outside competition pressing machine tool trade

BY OUR PARIS CORRESPONDENT

The effect of any trifling with tangible monetary assets on production costs in France remains still very indefinite. With the franc stabilized at its present low value (less than three cents) and the price of the workingman's loaf of bread six times what it was before the war, wages are bound to rise or production will be curtailed to a dangerous limit.

England has been buying coal in France as a result of the miners' strike in Britain. Attention has been called to the fact that this might prove a serious handicap for France. The government has accordingly put an embargo on the export of coal. Coincident with this the Alsace-Lorraine authorities have been asking the government to regulate coal prices for domestic and industrial use in these provinces as in the rest of France, coal being considered as a basic element of industrial prosperity.

GOVERNMENT HOLDS COPPER

During the recent discussion by the government commission of experts it was stated that the war department held stocks of copper to the value of more than a billion and a half francs and it was suggested to offer this in the open market to all takers.

French industry imports copper to the value of 750 million francs per annum. This dormant stock will permit French industry to avoid sending dollars and sterling abroad for a period of two years and make use of that which is already within the frontiers, thus adding a favorable chapter to the commercial balance sheet. What small demands exist are being filled slowly by the metallurgical industries.

The foundry industry is, for the moment, in a comparatively satisfactory state, as is that of bolts and nuts, the latter having raised the prices of its list once again. Rolling stock for railways is in a far less secure position, caused by deliveries from Germany. This applies to locomotives as well, and France has lost out on several requests for bids from foreign countries where business was offered for export. Scrap iron is being kept at home, save with small contingent concessions to Italy and Belgium.

Machine tools are feeling foreign competition as much as ever, so far as any notable demand for replacement is concerned, and this in spite of high exchanges and duties. The pressure is from the United States and Germany. It is more than likely that orders placed recently in France can not be duplicated at like prices in the near future.

Textile machinery is in a more favorable position, but imports from Great Britain during the first four months of the year represent approximately 50 million francs, which is about the equivalent of the season's business in 1925 and greatly in excess of that of 1924.

Plumbing supplies in nickel and bronze are only offered at prices of the day, with no guaranty of these figures for future delivery. Revised prices upward have recently been applied on locks, hinges and building hardware in general. Orders for hand tools for wood- or metal-working are diminishing in number and volume, even for export.

Makers of springs for carriages and wagons, automobiles and railway rolling stock are receiving advance orders for new season business, as are parts makers for the automobile industry, but with the latter in nothing like the proportions of the last three years. Prices have risen on all these items.

Cranes, lifting and sorting machinery of all kinds are benefiting from the limited contingents allowed to be imported and the increased tariffs which became operative as a result of the last finance bill. Prices are in general fixed.

Abrasive machinery and tools have undergone an advance in prices and a consortium of manufacturers has arranged for the bulk purchase of raw materials.

French railways are buying small accessory equipment parts for current needs and electrical equipment in accord with their vast electrification projects, but there is nothing new on record affecting the placing of rolling stock or motive power orders on a large scale.

The government post and telegraph department is asking for bids from time to time for weighing machines, electrical parts and hardware and fittings for immediate use.

An accord has been arrived at between Belgium and German makers of wire products and this is expected to affect the French export trade in these lines, which was fast gaining ground. The home demand for wire netting is virtually normal but few orders are in hand for future delivery, and the export trade will now have to face a stronger competition than before.

French imports of copper from the United States increased in April more than three million pounds over the same month last year; lead over a million and a half pounds, while zinc imports fell off nearly a million.

The labor situation, except for the uncertainty and stabilization of the wage scale, shows no particular unrest but taking into consideration what has happened to the franc something will perforce have to be done with the wage question when reorganization and readjustment sets in. The three vital issues which have affected production in France since the war are the reduction of the daily hours of labor, the fact that wages have risen faster that the general index number covering raw materials, and a general falling off in the quality of the product of this short-hour labor.

Hydraulic Engineers Find Business Better

The largest Canadian and American hydraulic pump manufacturers were represented at a convention of the Hydraulic Society, which was held on June 29 in the Ritz-Carlton Hotel, Montreal, Canada.

Subjects discussed at the sessions were of a technical nature, having to do with hydraulic pump manufacture and installation, but a statement indicative of the trend of business was made when it was announced that business in the United States and Canada during the past six months had been excellent, the increase over the same period of last year being from 5 to 10 per cent, depending upon the location of the company reporting. There had been a slight falling off during the last month, it was stated, but prospects indicated that the year's business would be greater than that of last year.

S. A. E. Approves More Standards

At the semi-annual meeting of the standards committee of the Society of Automotive Engineers, thirty-six recommendations for new standards were approved. The final step in the approval of the standards is the letter-ballot of the voting members of the society, and these will be sent out for return on July 24. The recommendations include new standards, or changes in standards, for roller-bearings, motor and generator mountings, drain plugs, crankcase lubricating oils, screw-thread fits and tolerances, and screw forms.

Report Shows German Machine Indusáry Is Progressive

The situation in the German machinery industries, as regards domestic sales, exports and imports in the first six months of 1926, indicates a better general position, according to a report to the Department of Commerce. Exports are increasing, imports are decreasing or stationary, and the domestic market is showing an increased capacity for buying German machines.

Exports of German machinery have increased since January, 1925, although there were small setbacks in February, May, July, and December of last year, and April of this year. Statistics just available covering the first four months of 1926 show that the volume this year is well above that for 1925. In March, 1926, the value of German exports surpassed the monthly average for 1913, which is the first time these shipments have reached the 1913 level. But inasmuch as 1913 was a peculiarly prosperous year, it is perhaps better to make comparison with the 1910-1913 period. Figuring values in gold marks and correcting the returns to allow for a price increase of 30 to 40 per cent during the interval, the value of German exports for the first part of 1926 is greater than for the monthly average during the 1910-1913 period, so that as measured by values Germany has only just regained her pre-war position as a machinery exporter.

If the tonnage of German machinery exports during the early months of 1926 is considered, the volume has not yet reached the pre-war level but is 80 per cent greater than in 1923, which was the low point for German export trade immediately following the time when the mark was stabilized.

The domestic market, according to German producers, is the true indicator of business conditions in the German machinery manufacturing industries. It is claimed that the German industry is working at only 65 per cent of productive capacity, in spite of the increase in export shipments. Domestic orders in 1926 are claimed to be only 50 per cent of the average volume of domestic orders in 1925.

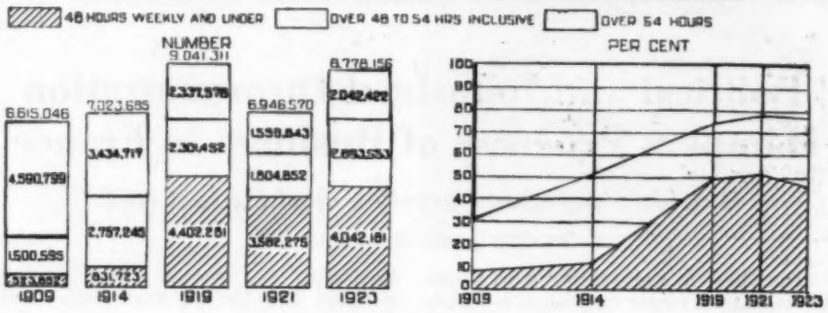
Many German manufacturing plants have been forced by circumstances to abandon old products and completely change to other lines. Companies formerly building railway cars are now trying to build steel office furniture, others formerly building machine tools are trying to develop a line of farm tractors. This situation is forcing a readjustment in the overhead organizations of most German manufacturers. Superfluous employees are being removed as rapidly as the circumstances surrounding their employment permit. This weeding-out process is continuing in the present months. Many firms report that they are still laying off as many unproductive workers as possible and using the available funds for increasing the technical efficiency of the plants by the installation of more modern machinery and manufacturing processes.

HOURS OF LABOR

MANUFACTURING INDUSTRIES—UNITED STATES

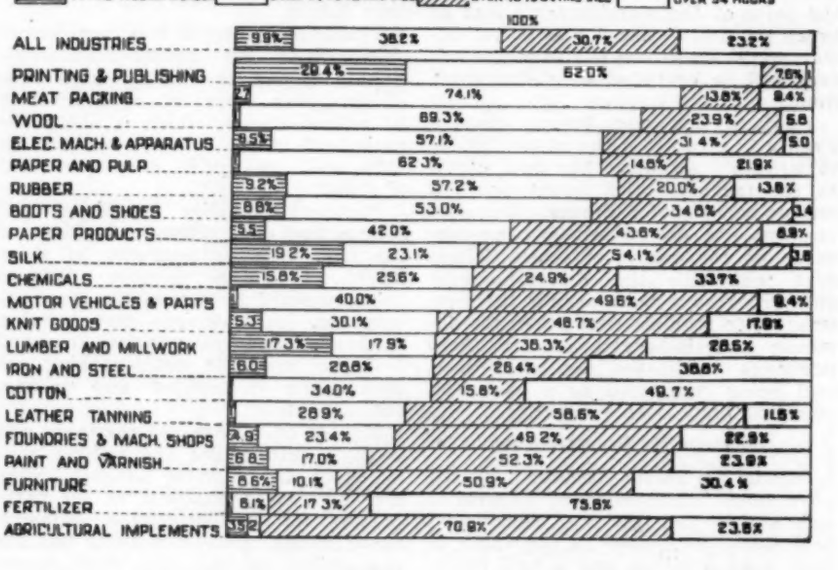
COPYRIGHTED BY
NATIONAL INDUSTRIAL CONFERENCE BOARD, INC.
NEW YORK CITY

WAGE EARNERS EMPLOYED IN ESTABLISHMENTS OPERATING



INDIVIDUAL INDUSTRIES—1923

PER CENT OF WAGE EARNERS EMPLOYED IN ESTABLISHMENTS OPERATING


44 HRS. WEEKLY & UNDER
OVER 44 TO 48 HRS. INCL.
OVER 48 TO 54 HRS. INCL.
OVER 54 HOURS
100%
ALL INDUSTRIES 9.9% 38.2% 30.7% 23.2%
PRINTING & PUBLISHING 28.4% 62.0% 7.6%
MEAT PACKING 2.7% 74.1% 13.8% 9.4%
WOOL 89.3% 23.9% 5.8%
ELEC. MACH. & APPARATUS 3.5% 57.1% 31.4% 5.0%
PAPER AND PULP 62.3% 14.8% 21.9%
RUBBER 9.2% 57.2% 20.0% 13.6%
BOOTS AND SHOES 8.8% 53.0% 34.6% 3.6%
PAPER PRODUCTS 5.5% 42.0% 43.6% 8.9%
SILK 19.2% 23.1% 54.1% 3.6%
CHEMICALS 15.8% 25.6% 24.9% 33.7%
MOTOR VEHICLES & PARTS 40.0% 49.6% 10.4%
KNIT GOODS 5.3% 30.1% 48.7% 17.9%
LUMBER AND MILLWORK 17.3% 17.9% 36.3% 28.5%
IRON AND STEEL 6.0% 28.8% 26.4% 38.8%
COTTON 34.0% 15.8% 49.7%
LEATHER TANNING 28.9% 58.6% 11.5%
FOUNDRIES & MACH. SHOPS 2.9% 23.4% 48.2% 22.9%
PAINT AND VARNISH 6.8% 17.0% 52.3% 23.9%
FURNITURE 6.6% 10.1% 50.9% 30.4%
FERTILIZER 8.1% 17.3% 73.8%
AGRICULTURAL IMPLEMENTS 3.2% 70.9% 23.8%

This chart, prepared by the National Industrial Conference Board, Inc., shows the changes in hours in the normal or prevailing work-week in American industry as a whole and the situation in the major groups of manufacturing industries in 1923.

It will be seen that the proportion of wage earners working on a schedule of more than 54 hours per week has decreased almost continuously since 1909, which is the first year in which statistics of this kind were gathered by the United States Bureau of the Census. The proportion of wage earners working on schedules of 48 hours and less per week increased slowly from 1909 to 1914 and very rapidly durinig the war period. Since 1921 the 48-hour week has tended to be less prevalent. Significant is the fact that the increase in the prevalence of working schedules exceeding 48 and including 54 hours per week, which was in evidence before the war, has been resumed since 1919. Nearly 80 per cent of the wage earners in manufacturing industries in 1923 were employed on a schedule of 54 hours per week or less.

During 1923, in seven of the twenty-one individual industries shown, more than half of the wage earners were employed in establishments where the prevailing work-week was 48 hours or less. Among the industries employing a larger proportion of wage earners on a weekly work schedule exceeding 54 hours than the average for the United States are fertilizer, cotton, iron and steel, chemicals, lumber and mill work, furniture, agricultural implements, and paint and varnish industries. The work-week of 48 hours or less prevailed more widely than the average for the United States in the printing and publishing, meat packing, wool, electrical machinery and apparatus, paper and pulp, rubber, boots and shoes, and paper products industries.

The chart pictures the great gain of leisure for industrial workers which improved management and increased productive efficiency in industry have made possible. It shows also the tendency of the industrial organization since the war to adjust its working schedule to a more stable basis, following the wide changes during the war period.

Russian Agreement With Machine Tool Builders in Germany

On June 5 the Association of Machine Tool Manufacturers, of Germany, held a meeting in which export possibilities for the German machinery industry were discussed.

The association has made a contract with the Russian Trust "Orga-Metall" of Moscow. This Russian company maintains engineering offices and is the official Russian government board for improving the technical equipment of the Russian factories. The German association and the Russian company are planning the establishment of a mutual consulting engineering office at Berlin W 15, Leitzenburgerstrasse 48. This firm will prepare specifications for the re-equipment of Russian factories; it will maintain a complete catalog library of German machinery for the benefit of the Russian organization, and will arrange a permanent exhibition in Moscow.

It is too early to predict the ultimate outcome of this enterprise on which the German machine manufacturers are placing very great hopes. It is feared that affairs will go smoothly only so long as the Soviet government can find a material advantage in keeping to the terms of the agreement. It is also expected that sales of German machines to Russia will be financed within the 300 million mark credit offered by the German government. A Russian railway purchasing delegation is expected soon in Germany.

Foundrymen Will Study Cost Systems

At a recent meeting of the American Foundrymen's Association's committee on foundry costs, a study was made of existing data of foundries having cost systems. The study lead to the conclusion that few foundries really know their actual castings costs and that the future work of the committee should be of a character to educate foundrymen to the needs of using adequate systems of a practical nature and to show the advantages to the foundry industry of using uniform cost methods.

A Systematic Plan

The committee plans to carry out its program by means of issuing reports and conducting discussion sessions at the annual meetings. The program planned for the 1926 convention, to be held at Detroit the week of Sept. 27, will include a discussion by E. W. McCullough, of the U. S. Chamber of Commerce, on the economic necessity of adequate cost information; an explanation of how foundry costs can be determined without excessive clerical detail, by R. E. Belt, of the American Malleable Castings Association.

The A. F. A. Cost Committee will present an outline basis for practical classification of foundry costs. In addition to the above program the committee is planning to conduct a contest on weight and production estimates of castings from non-ferrous steel, malleable and gray iron foundries. Pattern equipment for castings from each branch of the industry will be on display and those in attendance at the convention will be given a chance to submit their estimates of the weight of the castings and estimates of daily production by use of the equipment. Prizes are to be given to those submitting the best estimates. The purpose of the contest is to focus attention to the needs for accurate information regarding cost factors.

Papers for S.A.E. Meeting at Philadelphia in September

Latest developments in airplanes and aviation are to be discussed at the aeronautic meeting of the Society of Automotive Engineers, to be held in Philadelphia at the Bellevue-Stratford Hotel, on Sept. 2 and 3, immediately preceding the national air races.

There are to be three technical sessions, an aeronautic banquet the evening of Sept. 2, at which the principal speaker is expected to be a man who is famous for his recent achievements in aeronautic activities, and an inspection visit by the members and their guests on the afternoon of Sept. 3 to the Naval Aircraft Factory at Philadelphia, where a special exhibition of equipment and performance is promised.

At the technical sessions there are to be addresses as follows:

"Aircraft Engine Developments," by Commander E. E. Wilson, aircraft engine division, Bureau of Aeronautics, United States Navy.

"Air-Cooled Engine Developments," by G. J. Mead, Pratt & Whitney Aircraft Co., and E. T. Jones, Wright Aeronautical Corporation.

"Production of All-Metal Airplanes and Seaplanes," by Dr. Adolph Rohrbach, Berlin, Germany.

"Planes for Individual Ownership," by Elwood Junkin, Waco, Tex.; Edward Stinson, Stinson Sales Corporation; A. V. Verville, Buhl-Verville Aircraft Co., and a representative of the Travel Air Manufacturing Co.

"How I Fly at Night," by W. L. Smith, Air Mail Service pilot.

"Airway Illumination Equipment and Methods," by C. T. Ludington, B. B. T. Corporation of America, and H. C. Ritchie, General Electric Co.

"Direction Finding by Radio," by Lieut. L. M. Wolfe and Capt. W. H. Murphy, Air Service radio laboratory, McCook Field, Dayton.

The program and arrangements for the meeting are in charge of a committee composed of W. B. Stout, Stout airplane division, Ford Motor Co., Detroit, chairman; Paul Henderson, general manager National Air Transport, Washington; Glenn L. Martin, president Glenn L. Martin Co., Cleveland; Ralph H. Upson, chief engineer Aircraft Development Corporation, Detroit; E. P. Warner, professor of aeronautical engineering, Massachusetts Institute of Technology, Cambridge, Mass.; and J. E. Whitebeck, vice-president, Wm. E. Arthur Co., New York.

Japan Faces Favorable Season as Markets Look Upward

By Our Tokio Correspondent

Japan's stock and produce markets, influenced by favorable reports on American business, have executed an about-face during the last month. Optimism has replaced the gloom of the spring, security prices are rising, and the second boom of the last seven months is in progress.

Too many factors enter the situation, however, for reliable forecasts of the future. If the present bull market should last for some months it would probably be accompanied by a return of extensive buying abroad and the flotation of new manufacturing enterprises. For the last five years few new businesses have been started here. The nation has had all it could do to weather the financial storms occasioned by post-war readjustment and the earthquake of 1923

Rayon in Demand

Makers of machinery for rayon manufacture should find a ready market in Japan just at present. In spite of tremendous increases in domestic production, imports of the material for the first five months of 1926 were ten times those for the corresponding period of 1925 and more than double the entire 1925 total. Rayon has become the vogue. Even women who can afford real silk are using the substitute for their colorful sashes and kimonos, while the poorer classes are flocking to it in ever increasing numbers. Several large plants are in the course of construction and the Mitsubishi Goshi Kaisha and the Mitsui Bussan Kaisha, trade rivals, both have announced intentions of building "the largest rayon factory in the Orient." The Japan Spinning Co., the Toyo Spinning Co., and the Teikoku Gunpowder Co., are also planning to build. It is estimated that Japan's 1926 production of the commodity will be about 7,500,000 lb., in contrast to 3,200,000 lb. for last year. Plans now being made would put the 1928 production in the neighborhood of 35,000,000 pounds.

Naoharu Kataoka, Minister for Commerce and Industry, called a meeting last week in which he revealed Japan's plans for becoming self-supporting with regard to aluminum. The Empire now consumes 5,000 tons a year, all imported. Researches at the Government Industrial Laboratory, however, have resulted in the perfection of three methods of extracting the metal from clay, the so-called ammonium sulphate, sulphuric acid and sulphuric acid lime processes. Plans are on foot to form a company, with government aid, to embark upon the enterprise on an extensive scale.

The darkest cloud on Japan's economic horizon is Manchuria, one of her largest markets for cotton goods and flour, which seems threatened with famine, due to an unprecedented drouth which has wiped out between 40 and 50 per cent of her cereal crops.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

THE tide is always going out or coming in, but just before the turn the direction of the current is often imperceptible. So it is with business. There are times when it appears to be almost static, and it is difficult to say whether contraction or expansion is indicated.

This seems to be the case at present.

It would be easy to make one list of the favorable portents and another of those that are unfavorable, but when they were finished and weighed against each other the scales would still be in balance, for the economic equipoise is exceptional. The abundance of credit, the promise of good crops, the steady increase in bank clearings, the larger car loadings, the excellent railroad earnings and the constant gain in the business of the department stores, the chain stores and the mail-order concerns are some of the items that would be entered on the credit side of the account.

But offsetting the foregoing there would have to be considered the low price at which some farm products are selling, the agrarian discontent, the uncertainty of the autumn elections, the manifest reduction in the new building planned, the criticism to which one of the concerns selling real-estate bonds has been subjected in the state of Pennsylvania, the subsidence of several real-estate booms, the consequent suspension of an Atlanta trust company with its chain of 68 small banks in Georgia and Florida, the fresh obstacles that have been encountered by the Van-Sweringen railway consolidation and the foreign trade figures for June which show an excess of exports valued at only $1,000,000 and a "favorable" trade balance of less than $287,000,000 for the fiscal year ending June 30.

This list of things inauspicious might be somewhat lengthened if it included the recent happenings in Europe, for the British coal strike is still unsettled and French and Belgian francs have touched new "lows" despite the ostentatious activity of the financial ministers in both countries.

Many less important items might be entered on each side of the account, for it is indeed what the schoolmen call an "economic complex." In the face of conditions so inscrutable, the stability of the markets is wonderful and it can only be explained upon the assumption that the foundations of our prosperity rest upon a very solid basis. This assumption, which seems fully justified, is chiefly responsible for the steadiness of the stock market where good securities are still in demand. But the difficulty of getting an agreement between all who are interested in the Nickel-Plate consolidation of railways is getting on the nerves of the public and some impatient speculators have been selling out their long stocks.

What's Doing in Industry

July activity in the machinery industry is above the normal. Orders are coming in at a satisfactory rate in practically every large industrial center, and inquiries are more numerous now than they have been at this season of the year for a long time. The present demand is for machines of a high production character to replace tools that can not meet increased loads brought on by improved business conditions all over the country. Railroads are quite active and the automobile industry is again inquiring for new equipment.

In Chicago business so far this month has exceeded estimates and pending orders are expected to show a substantial gain by the end of the month. Cincinnati reports an improvement in the past week, with prospects bright for continued activity. Sales have increased in Detroit, expansions for fall production bringing orders from large automobile manufacturers.

Shops in the Milwaukee district are working on good schedules and orders are satisfactory. Inquiries portend some good business in the Cleveland territory. Philadelphia reports a better condition than at any time in the past two months.

The New York market continues at a fair pace with orders and inquiries ahead of expectations. Buffalo is quiet, but orders to date are better than in other years. The New England territory is gaining ground, export business having increased in the past few weeks.

The ship of business seems to be on an even keel. Mid-summer breezes are favorable and it is likely that business will be normally and essentially quiet until the trade winds of autumn commence to be felt.

The cotton market has been relatively steady. The insect damage is probably exaggerated, but the domestic consumption for June as reported by the census proved to be 5 per cent in excess of last year and a better demand for both cotton fabrics and raw cotton has made itself felt. The tone of the dry-goods market is in fact distinctly better, and people are wondering what has become of the widely advertised plans for curtailment that were first broached last March.

The tide in the wheat market has turned and prices are some four to six cents higher. The reason assigned is a reported reduction of 66 million bu. in the Canadian crop, but it is quite possible that the American farmer has had something to do with the advance, by refusing to sell at the low price recorded last week. Corn still reflects the anticipation of a big crop in the season just ahead.

At 5.70 f.o.b. New York, refined granulated sugar has touched the highest price of the present season but Cuban raws for future delivery have declined under selling that is attributed to some Cuban producers who needed money. The demand for Cuban sugar from the Far East and New Zealand has been an unusual feature of the market, which is rapidly getting into a position in which it will be responsive to bullish influences.

The continued advance in the milreis has thrown the coffee market into confusion and speculators are deserting it although the spot price is but little changed.

Rubber has been somewhat steadier on reports predicting a drastic reduction in foreign stocks unless the prices improve. Copper is above 14 cents for the first time in a long while. Just why is not apparent, but it is coming to be understood that the law of supply and demand has but little to do with the price of copper.

The optimists say there is a better demand for steel, but proof of it is difficult to obtain.

This about completes the roster of the important commodity markets. The changes noted are chiefly due to technical influences and are not otherwise significant.

The ship of business seems to be on an even keel. The mid-summer breezes are favorable but not unusually stiff and it is likely that business will be normally and seasonally quiet until the trade winds of the autumn commence to be felt.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

Buying activity continues at a fair rate in this market. Orders for machinery and machine tools are not large, but there is more general demand for single tools of a high production character than is customary at this season of the year. The reason for this is said to be the putting off of orders for needed equipment during April and May because of unsettled business conditions.

The best demand for tools at this time comes from general manufactures of hardware, electrical goods and a great variety of metal products. Railroads are in the market, the New York Central, the New Haven and the Chicago & Rock Island being mentioned as buyers. Large industrials and public utilities have not been buying much of late.

The following list gives some idea of the class of equipment now being purchased. This list is part of the purchases made last week: Two 26-in. shapers, 3 bench lathes, 2 bench millers, 2 thread millers, 6 Lincoln-type milling machines, 3 gear-shaving machines, 2 internal grinding machines, 3 geared-head lathes, 2 100-in. boring and turning mills. Besides these there was a variety of small tools, mostly of the automatic type.

Milwaukee

Opportunities for new business for makers of metal-working equipment are becoming more numerous, and local shops are enjoying a full measure of satisfaction from the number of orders that are being booked. It develops that the automobile industry, of which relatively little had been expected in the way of tool orders during the summer months, is producing business of considerable volume, although the buying is not general and is limited to a few concerns. These, however, represent some of the largest in the industry, and include factories that were believed to have met the bulk of their needs some time ago.

Makers of milling machines are operating at a rate comparable to the highest within a year's time or longer, and only a scarcity of competent skilled labor prevents a larger production. While the automobile trade is buying along broader lines, railroad business is increasing as well. There is also a good call for special production equipment whereby tools in service are brought to more varied purposes and the production range increased.

The tool trade looks forward to relatively active business which will demand a continuance of output at the present rate, probably until the beginning of the new year.

Cincinnati

Business has shown some improvement in the past week, according to reports of Cincinnati machine tool manufacturers. Selling agents also state that they made some gain in the week.

Both branches of the trade point out that as their business is better than it was in the corresponding period of last year, and as general business is improving, it is not probable that there will be the summer slump that some business forecasters predicted a few months ago. There is none of the pessimistic feeling but on the other hand there is a feeling that the sales-curve will continue slightly upward during the summer, after which it will rise more rapidly.

The feature of the week's market was the sale of single tools, for replacement purposes, to concerns in various lines, but some of the orders booked called for several tools. Purchases were well scattered geographically and well diversified as to sizes and types. Inquiries came in freely during the week, from all sections of the country and from all classes of machine tool users.

Railroads placed a few orders for single tools during week and sent in many inquiries, including some good-sized lists, asking for quotations. Orders from concerns in the automotive industries were confined to single tools, for replacement purposes. Manufacturers of automobiles have been sending engineers to this market, to investigate tools and get quotations, and it is thought that orders will follow before the fall season opens up.

Machine tool manufacturers expect to continue their output through the summer at its present level, at least, or perhaps a little greater.

Cleveland

Very little change was evident in the local market for the past fortnight. Business continues to be quiet and orders are coming in slowly. One or two exceptions are noted however, particularly in the automatic field, which is enjoying its best season since wartime. Recent acquisition of several large orders by one local manufacturer of this type of machinery has necessitated increasing the night shift.

Inquiries are increasing and with business now pending the prospects for the future are good.

A majority of the dealers and producers report business for the first half of 1926 far better than the same period of 1925.

Among the recent buyers in the Cleveland market were the National Lamp Co., American Steel and Wire Co., Glenn L. Martin Co. and the Toledo plant of the Chevrolet Motor Car Co.

Formal bids for $30,000 worth of tools for the manual training departments of the Cleveland School Board will be called for in August.

Chicago

Reports of a number of dealers handling various lines of machine tools, both metal and woodworking, are to the effect that the month of July, thus far, has yielded an unexpected and satisfactory increase in sales over the same period in June. Manufacturers' representatives say that, from present indications, July this year will run considerably ahead of July 1925, in point of the volume of business done.

Small electrically operated tools, in particular, are in active demand, the sales manager of one concern producing this line stating that the sales recorded by his firm the first week this month were almost equal to the total bookings of July last year. There is a brisk demand for electric grinders and buffers, manufacturers of which have been receiving recent orders almost taxing the capacity of their plants.

Railroad demand for machine tools is showing improvement, new lists having been issued which indicate that some worth while orders will be placed. Mining machinery manufacturers also have been active in the machine tool market, one of the largest of these being reported to have placed some heavy orders within the last few days.

Generally speaking, the machinery market shows an encouraging improvement, and this, it is believed, will be maintained for at least another month.

Buffalo

The machine tool trade in this district is somewhat quieter than was last reported. Even so July will doubtless compare favorably with July, 1925. The present tendency toward recession is attributed only to the vacation season. General business is good and inquiries continue to be good, but closings are not as frequently noted as was the case a fortnight ago.

However, the electric supply branch of the machine tool and equipment trade is somewhat above the average in its activity, as has been the case for several weeks. This is also true of the sale of contractors' supplies and equipment, which is considerably better than July, 1925. Optimism prevails and the trade believes conditions for future business to be basically sound, the only disconcerting factor being the occasional injection of used equipment into the market.

Philadelphia

Business in the machinery and machine tool industry continued on a satisfactory level during the last two weeks, according to reports from large producers and dealers in the Philadelphia area.

In the sales department of one of the city's largest producers, it was stated the production of cranes is particularly active with a sufficient number of orders to last for three months. Some railroad business is being received for machine tool business, but the orders from industrial establishments have not developed as well as some had hoped for.

The last few weeks have found orders more satisfactory than at any time in the last two months. Sales of small tools have fallen off somewhat.

The basic industrial and economic conditions continue satisfactory, except there are prospects of a slackening in building.

New England

Production in the machinery building plants of the New England territory continues at the same volume required during the past four months' period and as yet no indication of any curtailment appears. The sentiment of manufacturers is optimistic and with the first month of the quarter practically ended the consensus is that the third period will be productive of profits comparable with the two previous three month periods. The labor situation is satisfactory, no difficulties existing and no unrest indicated. Skilled labor is being employed where offered. Plant superintendents find their schedules are working out as planned.

Automatic machinery production is increasing, demand for export shipment being better this month than for several weeks previous. There is also a good demand for lathes and milling machines. Hand tools are also in good demand.

Contracting machinists report that their production is practically contracted for for a period of six months. Special machinery builders are also booked up to plant capacity for the rest of the year.

Detroit

With new models being announced by the automobile companies, prospects for machine tool and machinery sales in Detroit and southeastern Michigan appear brighter.

Several lists of new machinery are in the hands of representative dealers and the number of inquiries from both large and small manufacturing plants shows an increase. Both standard and special machines appear to be in demand, with most factories tooling up for fall production.

The Oakland Motor Car Co. is buying machinery in fairly large quantities. Production figures for Oakland and Pontiac call for approximately 400,000 cars next year. The new seven-million-dollar plant for the Pontiac is progressing rapidly, and part of the equipment has been ordered. Cadillac is bolstering its line materially, while Buick is buying in larger quantities than for some months. Chevrolet engineers are designing additions which will call for the expenditure of thousands of dollars for new machinery and tools.

Packard is once again buying new machines. For a short period the factory was closed tight, but the awarding of the government contract to Packard for new aircraft motors and the continued demand for both the single six and straight eight has forced the executives to order the replacement of much antiquated machinery.

Accident Prevention Gets Impetus at Meeting in Washington

The suggestion that there be created in the Department of Labor a bureau equipped to gather statistics on accidents and to disseminate information on the prevention of accidents, particularly in industry, was brought to a head at a conference in Washington on July 15 under the direction of Secretary of Labor Davis. Executives from many important industries and officers of trade associations and manufacturers' organizations, as well as representatives of labor bodies, attended the meeting.

In calling the conference, Secretary Davis asserted that "a conservative estimate indicates that the fatal industrial accidents in this country probably exceed 23,000 a year, and that nonfatal injuries total 2,500,000 a year."

Secretary Davis said that his experts had advised him that "fully 85 per cent of these accidents are preventable."

A letter from President Coolidge, in which he expressed hope that the conference would be successful in bringing about a reduction in the number of accidents, was read.

Louis Resnick, of the American Museum of Safety, indorsed Secretary Davis' suggestion, declaring that an educational program is needed "to reduce the wastage of life and limb that disfigures American industry."

Frank Morrison, secretary of the American Federation of Labor, said that the major responsibility for the 85 per cent of accidents that could be prevented rests with employers and the State governments.

Industrial accidents primarily concern the workers, Mr. Morrison said. The worker suffers to a degree, he declared, where the worker's compensation laws do not compensate. His family also suffers, he averred, being reduced to a lower standard of living.

Col. John Price Jackson, of the New York Edison Co., told the conference that the victims of industrial accidents —the widows, orphans and mutilated— "would make a couple of cities the size of Baltimore." Most accidents, he said, were caused by lack of sufficient care on the part of the workers themselves. He stressed the importance of compiling statistics showing the number of accidents. Without such statistics, he said, it is impossible to know whether conditions are improving or not.

What the Railroads Are Doing

The Baldwin Locomotive Works has booked orders for eight Pacific type locomotives for the Royal State Railways of Siam. Other orders placed during the last week include forty-seven express cars for the Seaboard Air Line, divided thirty-two to the Pullman Car and Manufacturing Co., and fifteen to the American Car and Foundry Co.; twenty-five gondolas for the National Tube Co., placed with the Pressed Steel Car Co., and fifteen all-steel passenger cars for the Erie Railroad, placed with the Standard Steel Car Co.

Among the larger orders for steel placed by the railroads were 37,500 tons from the United States Steel Corporation and 16,500 tons from Bethlehem Steel, both by the Norfolk & Western, and 3,000 tons of rails from Inland Steel and 7,000 tons from Bethlehem, by the Great Northern.

Orders for interlocking devices for the Seaboard Air Line, the Pennsylvania and the Atlantic Coast Line have been placed with the Union Switch and Signal Co.

A second oil-electric locomotive has been ordered by the New York Central R.R. for use on its West Side tracks in New York City. This locomotive will be of the 100-ton type. It is the joint product of the Ingersoll-Rand, General Electric and American Locomotive companies and its principal power equipment is an oil-engine generator set and a storage battery.

The Southern Railway System has announced the awarding of contracts for construction of machine shops, and several other shop properties, at Chattanooga, Tenn., at a cost of several hundred thousand dollars, work to start in the immediate future.

The Southern Railway Co., in Atlanta, announces the placing of an order with the Tennessee Coal, Iron and Railroad Co., of Birmingham, Ala., for 38,600 tons of rails to be used for construction of additional lines. The order amounted to $1,659,800. The rails will be made in the Ensley, Ala., plant of the Tennessee company. The Southern is contemplating a considerable expansion program during the year entailing an investment of several million dollars.

The Supreme Economic Council of the Ukraine has voted to purchase in Germany the Rheinmetall Locomotive Works, which will be moved to Lugansk in the Ukraine, according to advices from Kharkov to the Russian Information Bureau. The new plant, which is equipped with the latest modern machinery and is capable of turning out 500 locomotives a year, will be an important addition to the existing locomotive works at Lugansk.

The New Haven railroad will erect a new $300,000 railroad shop to replace one destroyed by fire early this year. The new building will have a steel frame and concrete foundation and the roof and sides will be 46 ft. high of one story design, to enable locomotives to enter and be raised for repairs.

News of the Automotive Industry

Removal of its manufacturing forces from Flint, Mich., to Elizabeth, N. J., on Sept. 1 was announced last week by the Flint Motor Co., organized by William C. Durant. It was also announced that Colin Campbell, vice-president of the Durant Motors, Inc., who is directing the Star division of that organization, will also direct the Flint operations.

The former plant of the Flint company in Michigan has been sold to the General Motors Co. for approximately $4,000,000. The plant at Elizabeth is said to be the largest single factory under one roof in the world. It occupies thirty-six acres and cost approximately $13,000,000 to build. The Michigan plant will be used by the Fisher Body Co. to build enclosed automobile bodies for the Buick Motor Co.

The Curtiss Aeroplane and Motor Co., Inc., states that the British government has standardized for pursuit planes and observation the Curtiss D-12 motor, which is now the standard pursuit motor of the United States. The company has contracted to deliver a quantity of these motors and parts to the British government and deliveries are now being made at the rate of about six a month. Arrangements have been concluded with the Fairey Aviation Co. of Great Britain under which the Curtiss product will be supplied to the British government for a period of years. The Fairey company will gradually adapt its plant to the manufacture of the Curtiss type of motor under Curtiss engineering supervision. Subsequently the Curtiss company will receive a royalty on all motors manufactured by the British concern.

For the week ended July 3, deliveries of new cars by Dodge Bros., Inc., dealers in the United States were 8,974, against 4,803 for the corresponding week of 1925, a gain of 87 per cent. Retail orders for new cars totaled 7,537, against 3,834 for the corresponding week last year, a gain of 97 per cent. Both deliveries and new car orders exceeded factory shipments which were 5,520 last week, against 5,035 for the same week a year ago.

Personals

S. M. WECKSTEIN has been appointed industrial equipment engineer for the Timken Roller Bearing Co., of Canton, Ohio.

RALPH SIMPSON, formerly with the Potter & Johnston Machine Co., is now sales manager for the L. J. Barrett Co., of Worcester, Mass.

H. E. STREETER has joined the sales force of Wilson-Brown, Inc., machine tool dealers, of 2 Rector St., New York. Mr. Streeter will cover part of the New York territory.

ROBERT W. GILLISPIE has been elected vice-president, assistant general manager and a member of the board of directors of the Jeffrey Manufacturing Co., of Columbus, Ohio.

C. S. WICKES has been appointed general superintendent of the Victor Talking Machine Co., of Camden, N. J. Mr. Wickes was formerly in charge of the Victor record department of the company.

JOSEPH K. POLLOCK has resigned as vice-president of Rogers, Brown & Crocker Bros., Inc., of Cincinnati. Mr. Pollock will retire to private life after thirty-five years in business.

WALLACE CLARK, well-known industrial engineer, has accompanied the group of expert economists and engineers who have gone to Poland to study the economic and financial condition of that country.

H. D. RANDALL has been made sales manager of the gear section of the industrial department of the General Electric Co. He will have his headquarters at the River Works, West Lynn, Mass.

FLOYD ROSE has been elected vice-president of the Vanadium Alloys Steel Co., of Latrobe, Pa. He was formerly general manager in charge of sales for the Hepenstall Forge Co.

GEORGE M. DYKE has been elected assistant secretary of the Chain Belt Co., of Milwaukee, to succeed C. E. Stone who is now vice-president and general manager of the Interstate Drop Forge Co.

C. A. COTTON, of 135 High St., Boston, Mass., has been appointed New England district sales representative for the Burke Electric Co., of Erie, Pa., manufacturer of electric motors, generators and welding equipment.

HENRY SHEARER, general manager of the Michigan Central R.R., has been appointed assistant vice-president and general manager with headquarters in Detroit. Mr. Shearer has been in continuous service with the Michigan Central since 1892.

L. J. BELNAP has been elected president of the Worthington Pump and Machinery Corporation. Mr. Belnap was formerly president of the Rolls Royce Co. of America. He succeeds C. Phillip Coleman, who has been elected chairman of the board.

GEORGE E. GUSTAFSON, sales engineer for the Kearney & Trecker Corporation, of Milwaukee, who has been traveling in the Eastern territory, will move to Detroit in September, where he will have his headquarters with the Chas. A. Strelinger Co.

J. G. MACLACHLAN, division engineer of the Kamloops-Kelowna Lumby line of the Canadian National Ry., has been appointed division engineer of construction, operation and maintenance of the Hudson Bay Railway, with headquarters at the Pas, Manitoba.

A. J. GERLACH has been appointed advertising manager of the Kearney & Trecker Corporation, of Milwaukee. G. L. Erwin, formerly advertising manager has been made supervisor of this department. Joseph Trecker has been appointed assistant to Mr. Gerlach.

J. C. COOK, assistant treasurer of the Asa S. Cook Co., manufacturer of wood screw machinery, of Hartford, Conn., has been elected president of the company to succeed his father, the late J. F. Cook. Frank Newton has been elected treasurer and R. S. Crosby has been appointed general manager.

W. S. JONES has resigned as vice-president of the Vanadium Alloys Steel Co., of Latrobe, Pa.

E. G. SCHLAYER has joined the service department of the Combustion Engineering Corporation, of New York.

ERNEST WOOLER, chief engineer of the Timken Roller Bearing Co., of Canton, Ohio, sailed on July 14 for England. Mr. Wooler will visit his home in that country. He came to the United States in 1913 with a party of British automotive engineers to study American practices and remained as an engineer for the Continental Motors Co.

D. W. McGEORGE has been appointed sales engineer of the Birdsboro Steel Foundry and Machine Co., of Birdsboro, Pa., manufacturer of hydraulic presses, rolling mill machinery, special machinery, steel castings and rolling mill rolls. Mr. McGeorge was previously connected with the sales department of the Edgewater Steel Co., of Pittsburgh.

Business Items

The Machinists Tool and Supply Co. has opened a salesroom and office at 1550 Kentucky Ave., Indianapolis, Ind.

The New York Wire and Spring Co. moved on July 1 from Hoboken to a new building at 136 Tichenor St., Newark, N. J.

The Chicago Pneumatic Tool Co. has purchased the property at Franklin, Pa., formerly owned by the Franklin Manufacturing Co., manufacturer of asbestos.

The Trumbull Electric Manufacturing Co., of Plainville, Conn., has purchased the plant of the Post-Glover Co. at Ludlow, Ky., and will establish there a base for manufacturing switches.

The Victor Oxy-Acetylene Equipment Co., manufacturer of cutting and welding equipment, has established an Eastern distributing station at 418 South Fourth St., St. Louis, Mo.

Plans are being prepared by the Dominion Power and Transmission Co. for the proposed new car shops, to be built at Hamilton, Ontario, at a cost of approximately $300,000.

The machinery, tools and equipment of Hinkley Motors, Inc., of Detroit, will be sold at auction on Aug. 17 and 18. The sale is under the direction of the Industrial Plants Corporation, of New York.

The Seifreat-Elstad Machinery Co., of Dayton, Ohio, has been appointed exclusive representative in southern Ohio, eastern Indiana and Kentucky, for the Cleveland Planer Co., of Cleveland.

The Continental Sales and Engineering Co., of Pittsburgh, has been appointed district representative in that city for the Kuhlman Electric Co., of Bay City, Michigan.

The Kearney & Trecker Corporation, of Milwaukee, announces the opening of a new branch office in Philadelphia, with headquarters at Room 328 Witherspoon Bldg. F. G. Jackson, direct factory representative, will be in charge.

The Hendey Machine Co., of Torrington, Conn., will take over the office of the W. M. Pattison Supply Co., of 1534 Dime Bank Bldg., Detroit, on Aug. 1. Edward B. Barker will continue in charge as branch manager.

P. M. Brotherhood & Son, of 25 Church St., New York, has been appointed exclusive sales agent in the eastern and western New York territory for the Cleveland Planer Co., of Cleveland.

The Chicago Pneumatic Tool Co. has purchased 12,270 sq.ft. of ground on Iron St., Chicago, and will buy from the trustees of the Central Manufacturing District, in which this site is located, a two-story mill of brick construction.

The Faget Engineering Co., of Beach and Taylor Sts., San Francisco, Calif., manufacturer of ice making and refrigerating machinery, sustained a loss of $25,000 by fire on July 3 which destroyed a large quantity of machinery.

The Continental Machine Co., of Minneapolis, Minn., has been organized to take over the business of the Wilkie Machine Works, of Winona, Minn., manufacturer of precision garage machine tools. The Continental company has established a plant and offices at 1301 Washington Ave., South, Minneapolis.

The M. & H. Valve and Fitting Co., of Anniston, Ala., has announced an increase in the capital stock to $300,000, and plans for expanding the plant in a few months. It is also announced that J. W. Conway, of Atlanta, was re-elected president. An additional machine shop is now being erected at the plant.

The Aero Corporation of America, organized last month to operate an airship service on the Atlantic Coast, elected the following officers at a meeting last week: William H. Fisher, president; Captain Anton Heinen, vice-president; William H. Leary, secretary; and H. G. Greene, treasurer. Headquarters have been established at Toms River, N. J.

The Victor Oxy-Aceylene Equipment Co., manufacturer of cutting and welding equipment, has opened an Eastern factory branch and distribution center at 418-420 South Fourth St., St. Louis, Mo., with A. W. Henry in charge as manager. The company's main plant and general offices are in San Francisco.

The Triumph Electric Corporation has been organized to take over the good will, designs, records, patent rights and inventions of the Triumph Electric Co. So far as is practical the new company will retain the old personnel. The new company will specialize on its self-start, automatic, heavy-duty motor and at the same time be in a position to supply its other lines of electrical and refrigerating products.

The Eaton Axle and Spring Co., of Cleveland, announces the opening of a new Southeastern distributing branch at 18 Hunnicutt Place, Atlanta, operating under the name of the Eaton Bumper and Spring Service Co., with George W. Klier in charge as district manager. The new branch will direct sales in the Georgia, North Carolina, Virginia, East Tennessee and Florida territory

The Simonds Saw and Steel Co., of Fitchburg, Mass., has obtained a warehouse and shop space in Atlanta at 100 S. Forsyth St., where a new Southeastern branch is being established, with F. H. Horton in charge as manager of the district. The branch will probably be ready to open before the end of July. The new district will comprise the states of Georgia, Florida, and North and South Carolina.

William H. Barr, Inc., has been organized at Buffalo, N. Y., to conduct a brass foundry. A plant has been secured at 27 Carolina St., in Buffalo. Mr. Barr has for several years been president of the National Founders Association and is well known among machinery builders and users. John C. McCallum is general superintendent. The present plant will be in full operation by Aug. 1 and will be equipped with the most modern molding machinery, furnaces and cranes for the manufacture of all kinds of brass and bronze castings.

Obituaries

WILLIAM RAYMOND dean of the College of Engineering, University of Iowa, died at Iowa City on June 17. He was 68 years old. He had been associated with this college since 1905.

J. F. COOK, president and treasurer of the Asa S. Cook Co., of Hartford, Conn., died suddenly on July 5 in that city. Mr. Cook had been connected with the company since 1871 as general manager, and in 1924 was made president.

JOSEPH H. FOSTER well-known in New England as an inventor of machinery, jigs and fixtures used in shops connected with the textile industry died in Providence, R. I., on June 29. He was 80 years old, and had retired several years ago.

ERNEST G. YEATES, president of the Yeates Machinery Co., London, Ontario, Canada, died on June 30. For many years Mr. Yeates was associated with the London Machine Tool Co., and also with the Westinghouse company in Pittsburgh.

WILLIAM A. LANGSENKAMP, president of the Langsenkamp-Wheeler Brass Works, of Indianapolis, died at his home in Indianapolis recently. He was 55 years old. With his brother he entered the brass and finishing business in Indianapolis in 1895, the firm being known as Langsenkamp Brothers' Brass Works. In 1905 the company was incorporated under the name of the Langsenkamp-Wheeler Brass Works, and, since the death of F. H. Wheeler, Mr. Langensenkamp had been president of the company.

CHARLES ALBERT COFFIN, founder and former chairman of the board and president of the General Electric Co., died at his home in Locust Valley, Long Island, N. Y., on July 14. He was 82 years old. Mr. Coffin was president of the General Electric Co. for many years and received from his associates much of the credit for the rapid and sound development of the company. One of his achievements was the organization of its research laboratory at Schenectady. Mr. Coffin was president of the company from its organization until June, 1913, when he was made chairman of the board. He retained this office until 1922, when he retired.

WILLIAM WELSH SANDERSON, general sales manager of the Carborundum Co., died on July 6 at his home at Stratford, Ont., Canada, after a long illness. Mr. Sanderson was 46 years old. He entered the employ of the Carborundum Co. in 1901 as a clerk in the billing and order departments. In 1904 he was appointed to the sales staff and for many years was the company's sales representative in the South. In 1909 he was made district sales manager for the Pittsburgh territory and for ten years was in charge of the warehouse, office and sales force in that city. In 1919 he was appointed general sales manager, succeeding George R. Rayner, who was made vice-president of the company.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

The Weekly Price Guide

Rise and Fall of the Market

THE average price of pig iron is down about 25c. per ton from the July 15 level; scrap and coke, however, gain in firmness. Steel prices show marked upward tendencies, bars particularly. Inquiries appear more active in plates; steel pipe continues in fair volume. Bars and shapes hold at last week's quotations of $2 per 100 lb. for carload quantities at Pittsburgh mills; $1.90 is still mentioned on those and plates. Black and blue-annealed steel sheets declined 10c. per 100 lb. at Pittsburgh mill, compared with July 1 quotations. Most of the non-ferrous metals show upward price tendencies. Highest grade babbitt metal is up 1c. per lb. at New York, compared with the July 16 level.

(All prices as of July 16)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00@21.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue-Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.15	3.50
No. 12	2.35@2.45	3.94	3.20	3.55
No. 14	2.40@2.50	3.99	3.25	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.80@2.95	4.30	3.65	3.90
Nos. 22 to 24	2.85@3.00	4.35	3.70	3.95
Nos. 26 and 27	2.90@3.05	4.40	3.75	4.00
No. 28	3.00@3.15	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.40	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.50	4.75	4.10	4.35
No. 16	3.45@3.65	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.80	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.95	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.10	5.35	4.70	4.95
No. 28	4.20@4.40	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	58%	45%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	55%	42%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.50
Tin, 5-ton lots, New York			65.00
Lead (up to carlots) E. St. Louis	8.50	New York	9.00
Zinc (up to carlots) E. St. Louis	7.52½	New York	8.50

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	15.00	17.00	14.50
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.25	16.50	16.00
Copper bars, base	22.12½	22.12½	21.87½@22.12½
Copper tubing, base	24.25	24.25	24.25
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.50	23.50	23.50
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.00	12.55	11.51
Solder (½ and ½), (case lots)	39.87½	40.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	78.00
Commercial genuine, intermediate grade	55.00
Anti-friction metal, general service	30.50
No. 4 babbitt (f.o.b.)	14.25

Nickel, f.o.b. refinery, cents per lb.:

Ingots	31.00	Electrolytic	38.00
Shot	32.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00 @12.25	11.25	11.25@11.75
Copper, heavy, and wire	11.25 @11.75	11.50	10.75@11.25
Copper, light, and bottoms	9.62½@10.12½	9.75	9.75@10.25
Heavy lead	7.00 @ 7.25	6.75	6.75@ 7.25
Tea lead	5.00 @ 5.50	4.75	5.50@ 6.00
Brass, heavy, yellow	6.75 @ 7.00	7.25	7.50@ 8.00
Brass, heavy, red	9.25 @ 9.75	9.50	8.75@ 9.25
Brass, light	5.75 @ 6.00	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.00 @ 8.50	8.00	7.75@ 8.25
Zinc	4.25 @ 4.75	4.50	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.16
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb	3.60†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.94½	1.00	.91
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. kegs. †Per 150 lb. lot. ‡Per 425 lb. barrels

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1662½	.1662½	.1587½
Solder (½ and ½)	per lb.	.3987½	.3675	.395
Cotton waste	per lb.	.13@ 17½	.13@.17½	15@22
Washers, cast iron (¼ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	35
Belting, leather, medium	off list	40–5%	40–5%	30–10%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.75@ 3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@ 4.50
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{1}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{3}{16}$-in and smaller and 65% for ¼-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ½-in., ¾-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1¼ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Pittsburgh — Pittsburgh School Dist., A Stow, Clk.—shop machinery and equipment for school departments.

Ill., La Salle—N. L. Hall, Box 282 (sheet metal works)—corrugating roll for 18 in. width and ½ by ½ in. corrugation.

Ill., Melrose Park—Mississippi Valley Structural Steel Co., 208 South La Salle St., Chicago, W. M. Wood, Pres. and Treas.—punches, shears, coping machines, electric welders, riveting machines, etc., for proposed 1 story, 375x375 ft. factory here. Estimated cost $500,000

Ind., Anderson—Remy Electric Co., Div. of General Motors Co.—machinery for the manufacture of starting motors for automobiles for proposed 1 story, 243x535 ft. building, plant 6. Estimated cost $300,000.

Mass., Boston—Baker, Seleznick & Kaplan, 174 Hampden St.—miscellaneous tools and equipment for repair and service garage. Estimated cost $50,000.

Mass., Boston — Schoolhouse Dept., City Hall—metal working machinery for J. H. Barnes school, East Boston.

N. Y., Brooklyn—Buckle Proof Shingle Co. Inc., 403 St. John Pl.— power punch press with 20 in. bolster and 42 in. squaring shear.

O., Cleveland—McKinney Tool Co., E. W. McKinney, Pres., 15215 Utopia Ave., machinery and equipment for proposed 1 story, 40 x 100 ft. factory. Estimated cost $40,000.

O., Norwood—Chevrolet Motor Co.—complete equipment for proposed 2 story, 125 x 425 ft. addition to factory for Fisher Body Co. plant.

Tex., Palestine — International-Great Northern R.R. Co., Union Station, Houston, J. H. Lauderdale, Gen. Purch. Agt.—metal planers, flanges, drills, etc. for proposed extensions and improvements to shops.

Wis., Milwaukee—C. W. Valencourt, 1614 Fond du Lac Ave.—repair shop equipment for proposed 6 story, 90 x 120 ft. garage. Estimated cost $200,000.

Ont., Oshawa—General Motors Corp.—complete equipment for the manufacture of Pontiac cars for proposed 1 story, 100 x 690 ft. extension to plant. Estimated cost $200,000.

Que., Baie St. Paul—E. Boivin—foundry equipment for proposed extension to plant.

Que., Limoilou—Quebec Power Co.—machinery and mechanical tools (later) for proposed 200 x 387 ft. work shop. Estimated cost $216,000.

Opportunities for Future Business

Ark., Walnut Ridge—Campbell Heinz Co., Federal Bank Bldg., Memphis, Tenn., plans the construction of a zinc concentrating plant here.

Calif., Alhambra—Kay Steel Wheel Co., c/o Austin Co., 777 East Washington St., Los Angeles, Contr., awarded contract for the construction of first unit to factory here. Other units to be built later.

Calif., Los Angeles—F. C. Hill, c/o K. MacDonald, Jr., Archt., Brack-Shops Bldg., is having preliminary plans prepared for the construction of a 13 story garage on Spring St. Estimated cost $500,000.

Calif., Roseville — Pacific Fruit Express Co., 65 Market St., San Francisco, awarded steel contract for the construction of 36 railroad car building, shops etc., here. Estimated cost $1,500,000.

Conn., Naugatuck — Eastern Malleable Iron Co., Union City, Naugatuck, Conn., awarded contract for the construction of a 1 story, 125 x 200 ft. plant. Estimated cost to exceed $40,000.

Ill., Chicago—Chicago Steel Tank Co., 1301 South 55th St., awarded contract for the construction of a 2 story, 100 x 500 ft. factory on Narragansett Ave. Estimated cost $200,000.

Ind., Evansville — Chicago & Eastern Illinois Ry. Co., 66th St. and Union Ave., Chicago, Ill., awarded contract for the construction of a round house and machine shops here. Estimated cost $500,000. L. C. Hartley, Chicago, Ill., Ch. Engr. Noted May 27.

Me., Orono—University of Maine, H. S. Boardman, awarded contract for the construction of a 2 story mechanical engineering building. Estimated cost $150,000.

Mich., Detroit—Continental Tool Co., S. F. Wall, Pres. and Treas., McGraw St., awarded contract for the design and construction of a 1 story machine shop to The Austin Co., General Motors Bldg. Estimated cost including equipment $250,000.

Mich., Detroit—A. Kahn, 1000 Marquette Bldg., Archt., is receiving bids for the construction of a 3 story, 60 x 264 ft. assembly plant at East Grand Blvd. and Concord Ave. for Packard Motor Car Co., East Grand Blvd.

Mich., Detroit—L. A. Young Industries, 9200 Russell St., manufacturers of wire springs, etc., awarded contract for the construction of a 5 story factory on Holbrook Ave. Estimated cost $300,000.

Minn., St. Paul—Auto Engine Works, Griggs St. and University Ave., awarded contract for the construction of a 1 story, 100 x 200 ft. factory and machine shop at St. Anthony and Hamline Aves. Estimated cost $50,000. Noted Apr. 1.

Minn., St. Paul—Mack International Motor Truck Corp., T. F. Egan, Mgr., 2231 University Ave., awarded contract for excavation for a 1 story, 200 x 300 ft. assembly plant at University Ave. and Cromwell St. Estimated cost $20,000. Total estimated cost $300,000.

Mo., St. Louis—St. Louis Car Co., 8000 North Broadway, awarded contracts for the construction of additions to car plant including 130 x 1,000 ft. main building for steel fabricating and erection of cars, 60 x 100 ft. building for housing light steel materials, etc.

N. Y., Albany—Mack International Motor Truck Corp., Broadway and Emmet St., will soon award contract for the construction of a 1 story, 190 x 288 ft. sales and service station. Estimated cost $260,000. Faile Seelye & Co., 101 Park Ave., New York, Engrs.

N. Y., Poughkeepsie — State Highway Comm., A. W. Brandt, Comr. of Highways, Albany, will soon award contract for the construction of a 2 story, 68 x 188 ft. shop near here. Cost $54,349. Noted July 1.

N. Y., White Plains—International Motor Truck Corp., 25 Broadway, New York, awarded contract for the construction of a sales and service station on Kensico Ave. here. Estimated cost $175,000. Noted Apr. 8.

O., Alliance—Alliance Tank Co., E. L. Kobler, Pres., manufacturers of light tanks, plans the construction of a factory at Belt Ave. and New York Central R.R. tracks. Estimated cost $40,000 to $50,000.

O., Cleveland—F. & W. Folberth, 7908 Lake Ave., manufacturers of automobile accessories, awarded contract for the construction of a 1 story, 47 x 158 ft. factory at 7900 Lake Ave. Estimated cost $50,000.

O., Dayton—Delco-Light Co., Third National Bank Bldg., manufacturers of Frigidaire machines, awarded contract for the construction of a 1 story, 200 x 2,600 ft. factory at Movaine City. Estimated cost $500,000. Noted June 24.

Pa., Boyertown—Boyertown Casket Co., awarded contract for the construction of a 5 story, 80 x 200 and 40 x 60 ft. addition to factory.

Pa., Derry—Westinghouse High Voltage Insulator Co., awarded contract for the construction of a 1 story, 96 x 96 and 24 x 40 ft. casting building. Estimated cost $40,000.

Pa., Fox Chase (Philadelphia P. O.)—Electric Storage Battery Co., 19th and Allegheny Sts., Philadelphia, awarded contract for the construction of a 2 story, 169 x 189 ft. factory on Hunting Pk. Ave. here.

Pa., Oil City—United Natural Gas Co., awarded contract for the construction of a 1 story, 120 x 130 ft. machine shop. Estimated cost $60,000.

Pa., Philadelphia—Ajax Metal Co., 46 Richmond St., will build a 1 story, 21 x 50 ft. manufacturing plant at 1107 Dunton St. M. W. Easby Co., 1505 Race St., Engr.

Pa., Philadelphia—Smith Drum Co., 5th and Allegheny Sts., will soon award contract for the construction of a 1 story, 100 x 125 ft. shop. J. Sinsohn, Broad St. and Gerard Ave., Archt.

Pa., Philadelphia—Willard Chevrolet Co., 4131 Frankford Ave., plans the construction of an auto repair shop. E. Schoeppe, 1437 Spruce St., Archt.

Pa., Pittsburgh—Pittsburgh Rolls Corp., 42nd St., awarded contract for the construction of a 1 story, 73 x 130 ft. plant. Estimated cost $40,000.

Pa., Scottdale—U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, New York, N. Y., awarded contract for the construction of a 1 story, 60 x 171 ft. addition to coating plant here. Estimated cost $50,000.

Pa., Sharon — Westinghouse Electric & Mfg. Co., Walnut and 30th Sts., Philadelphia, will build a 5 story, 72 x 220 ft. addition to plant here. Estimated cost $250,000. B. H. Prack, Martin Bldg., Pittsburgh, Archt. and Engr. Noted June 3.

Pa., Washington—Washington Mould Machine & Foundry Co., will soon receive bids for the construction of a 2 story, 55 x 135 ft. machine shop on East Bean St. Estimated cost $40,000. A. L. Hauser, Renshaw Bldg., Pittsburgh, Archt.

R. I., Westerly—Westerly Light & Power Co., will soon award contract for the construction of a 3 story, 55 x 85 ft. sales and service station. Estimated cost $100,000. Jackson Robertson & Adams, 1216 Turks Hd. Bldg., Providence, Archts.

Wis., Appleton — City, E. L. Williams, Clk., will soon receive bids for the construction of a 1 story, 120 x 130 ft. garage and repair shop on W. Washington St. E. A. Wettengel, 116 S. Pierce Ave., Archt.

Wis., Edgerton—Highway Trailer Co., J. Menhall, Mgr., will build a 1 story, 50 x 128 ft. addition to shop. Estimated cost $40,000. Private plans.

Wis., Milwaukee—Badger Meter Mfg. Co., 841 30th St., is having revised plans prepared for the construction of a 2 story, 60 x 120 ft. addition to factory. M. Tullgren & Sons Co., 9 Waverly Pl., Archts. Former bids rejected. Noted July 8.

Wis., Racine — Standard Foundry Co., 1600 Kewaunee St., will soon receive bids for the construction of a 1 story, 112 x 240 ft. foundry. Estimated cost $150,000. A. A. Wickland & Co., 5 S. Wabash Ave., Chicago, Ill., Engrs. June 24.

Ont., Toronto—Canadian National Railways, Montreal, Que., awarded contract for the construction of a group of buildings for engine and car facilities. Estimated cost $300,000. C. S. Gzowski, Ch. Engr.